AMERICAN MACHINIST

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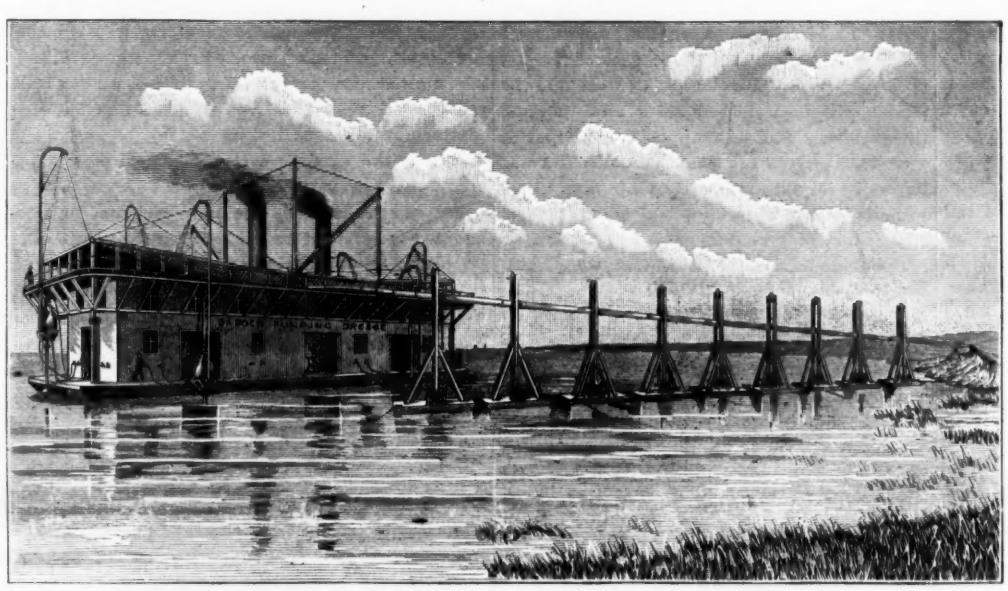
ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

The Badger Pumping Dredge.

This machine is designed for use for most purposes for which an ordinary dredging machine is used, viz., for removing mud, sand, gravel, clay and other material from under water and depositing it to a distance, as in deepening channels, removing bars, filling in low lands, digging canals, mining and similar operations. The active principle is the pulsometer steam pump. The structure consists of a strongly-built boat, adapted to receive and supplied with boiler and necessary hoists and winches. Upon this boat is erected a heavy frame-work 25 feet in height, with strong cross timbers at the top extending over and beyond the sides and ends of the boat. Underneath these timbers and extending continuously around the boat are heavy iron channel beams, curved at the corners, and forming, with their lower corners, a track for a four-wheeled truck, having flanged wheels. From the body of this truck the dredging pumps are suspended by pulley-blocks and chain, the latter extending to the steam hoist inside the boat. The frame-work is enclosed, forming a lower floor for machinery and boilers, and an upper floor for kitchen, dining-room, office, state-rooms, etc.

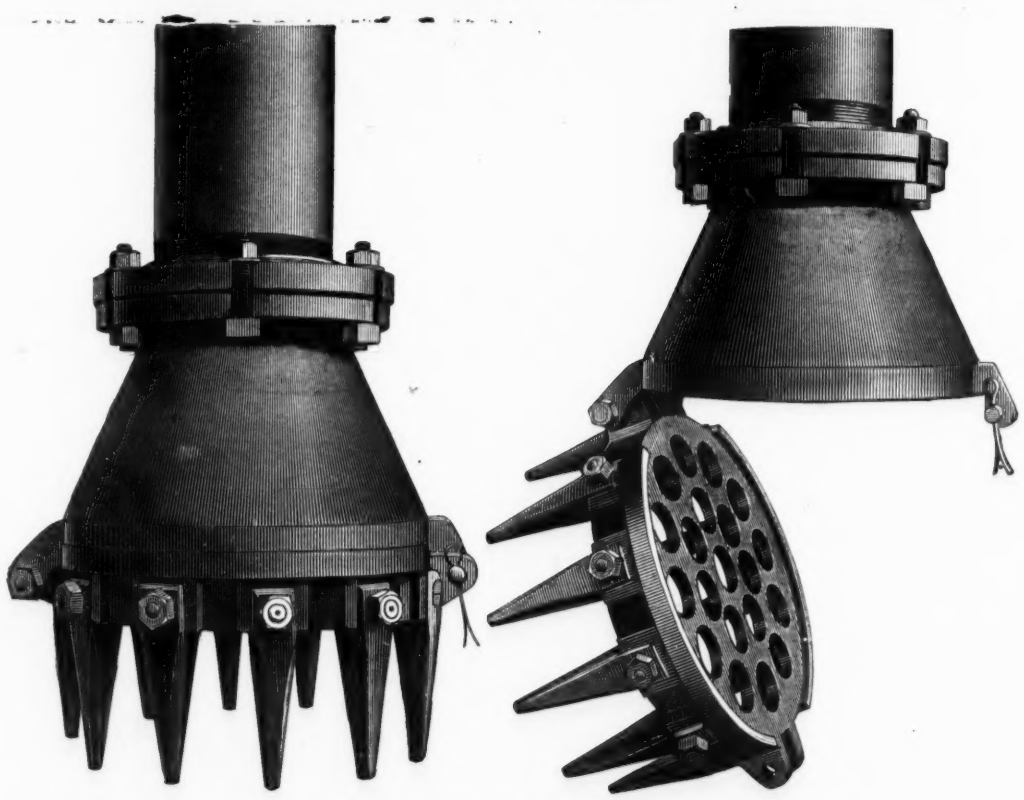


THE BADGER PUMPING DREDGE.

A suction pipe of iron extends downward from the pump, and to the bottom of this is attached the digger and strainer, shown in the engravings. The digger is for loosening the material so that it will be drawn up in the suction pipe, and the strainer for excluding anything too large to pass the pump valves. The strainer and digger are hinged so as to be dropped for cleaning when necessary.

When the pump is lowered down to the sediment under water, the digger has the entire weight of the pump, etc., about two tons, which, with the oscillating movement given to it by the pump when in action, effectually loosens the material.

The iron discharge pipe, flanged with gun-metal flanges, screwed and riveted on, extends from the discharge of the pump to the rolling truck and through a strong collar attached to this truck, from which the pump is suspended. The pump and truck are thus free to move to any desired point on the channel beam track. At the top end of the discharge pipe is flanged a galvanized-iron "goose-neck," which leads from any point towards a central hopper, from which last passes the trough or pipe for conveying the dredged material ashore. The sediment being discharged at a considerable height above the water, it is possible to deposit it either in a pile on the shore or convey it a distance of from 500 to 1,000 feet from the boat; water pumped into the hopper may be used for aiding the flow if this is required. The sediment can be delivered into an elevated tank on pontoons, towed to any distance, and the material washed back by hydraulic force where required.



DIGGER AND STRAINER.

The pump is operated by a steam pipe extending entirely around the boat, provided with suitable branches and valves at proper points. A water pipe also extends around the boat, connected with a pulsometer in the hold of the vessel; this water pipe has appropriate branches and valves, to which a strong connecting hose can be attached leading to the discharge cover of the pump. The purpose of this water pipe is to keep the lifted material in motion when from any cause the pump itself is stopped, and thus prevent the settling and packing of the sand, etc.

At Coney Island, where this dredge has been at work, as much as 80 per cent. of sand has been raised, and no trouble has been found in making it average 50 per cent. of solids in the volume lifted.

The pulsometer used represents the recent improvements in that instrument, by which its construction has been much simplified and its efficiency increased.

The dredge illustrated is the one constructed for working at Coney Island, and is said, under favorable conditions, to have a capacity of ten cubic yards per minute.

The inventor is G. F. Badger, secretary and general manager of the Pulsometer Steam Pump Company, 83 John Street, New York.

Thomas Pray, Jr., long known to readers of trade journals as having occupied several important editorial positions, has accepted a situation as general superintendent of the Mather Electric Company, of Hartford, Conn. His many friends will wish him success in his new position.

Early Engineering Reminiscences.

BY GEORGE ESCOL SELLERS.

NINETEENTH PAPER.

At the Chicago National Railway Exposition there was exhibited, by the Baltimore and Ohio Railroad Company, an old relic of the most interesting character, the old locomotive Arabia, an engine that went into service on that road in June, 1834, and has been well preserved, and was still doing good service in the yards of the Mount Clare workshops after a lifetime lacking but one year of a half century; undoubtedly the oldest effective locomotive in the world. I remember this engine on its first trial on the tracks at the machine shops, and as exhibited it is the same engine; the only change I noticed was dispensing with the fan blowers that urged the fire and substituting the draft made by the exhaust steam.

Seeing this old relic brought vividly to mind my first acquaintance with Phineas Davis, its designer and constructor, and incidents that occurred at the time of our first meeting, and I have no doubt had an influence in directing his mind in the bent that produced his first small 2½-ton engine built at York, Pa., and afterwards the Arabia built in the shops of the Baltimore and Ohio Railroad Company.

Peter Cooper's little engine, that was tried on the Baltimore and Ohio Railroad in 1830, has the credit of drawing the first passenger cars in America. If my recollection is not entirely at fault, it only made a few trips from Baltimore to the Relay House, and was followed by two attempts by Reeder, of Baltimore, neither of which was successful; then came Davis's little engine that took the place of horses, but was found too light for the increasing traffic even for the short distance to the Relay House and Ellicott's Mills, and Davis, who had become foreman of the shops or master mechanic of the road, designed the Arabia, taking a bold leap for the time from a 2½-ton engine to one of 13 tons, and that for a strap-bar rail on wooden stringers.

When George King, of York, Pa., a paper maker, would come to us for paper moulds (it was the time of hand-made paper), he always had something to say about Phineas Davis, a young man of York, whom he considered a prodigy in mechanics; he could turn his hand to anything; he could reface paper moulds with wire cloth, form the letters and devices in wire for water marks and sew them on the moulds as well as the most experienced hand; he told us of a patent lever watch that Davis had made, and so small that he could cover it with a levy, the old Spanish coin, the $\frac{1}{8}$ of a dollar, in Philadelphia called eleven penny-bit or levy for short, and in

New York a shilling. The next time Mr. King came to the city he brought the watch to show us; as I recollect it, it was about the size of our 20-cent piece. It was a beautiful piece of workmanship considering the tools Davis had at his command. Mr. King represented that he had never had an opportunity of seeing how work was done outside of the watch repairers, blacksmith and gunsmith shops of York, that he was very anxious to see how work was done on a larger scale. My father sent an invitation to him to pay us a visit, saying that my brother and myself would show him what we could among the shops. The little watch was left with me, and remained in my possession for some weeks until Phineas made his appearance. His stay was only a few days, but no time was lost, for a more eager one to see all that was to be seen I never met. I cannot, with certainty, fix the date of this visit. It was either 1828 or 1829. Mason & Baldwin had just put in operation a small novel and ingeniously constructed vertical steam-engine in their works for manufacturing bookbinders' tools and calico-printing cylinders. This was particularly attractive to Davis, and Mr. Baldwin had much to say as to the importance of vertical cylinders not being subject to the wear of the piston and cylinder as in the horizontal engines, even going so far as to predict that, at no distant time, a horizontal steam engine would not be known, and as for water pumping engines, that are always subject more or less to sand and grit, the wearing was so serious on the lower side of horizontal cylinder that, although Mr. Frederick Graff had so arranged the cylinders of the great pumping engines at Fairmount dam, which supplied Philadelphia with water, that they could be taken out and rebored or replaced by new ones without disturbing the rest of the machinery, they would have to give way to vertical pumps. This evidently made a strong impression on young Davis. It must not be forgotten that this was before the time of efficient tools, and that the little cylinder of Baldwin's vertical engine was bored by hand by bits set in a wooden boring block.

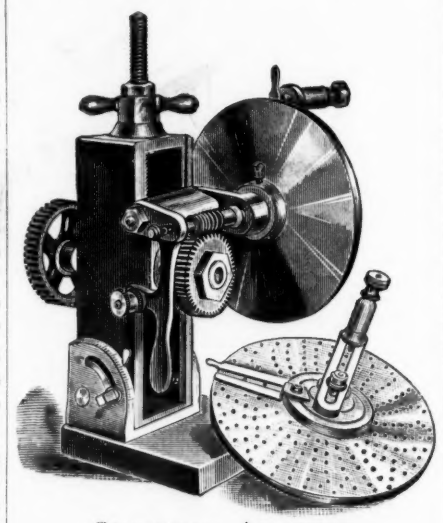
From Mason & Baldwin's shop I took Davis to the Philadelphia Museum, which at that time was under the management of my uncle, Franklin Peale, with his brother Titian R. Peale as naturalist. I introduced Davis to the latter, whom we found in the taxidermic room busy among animal and bird skins, mounting specimens; this I thought would interest him, but I was mistaken, for as we passed through the little workshop of my Uncle Franklin, his eye had caught sight of a model steam-engine on wheels. This stood on a shelf nearly hidden by a heterogeneous mass of gimcracks piled over it, essays at perpetual motion, model churns, plows and such like, that had found their way to the museum and were not considered as worth being put on exhibition. It was soon evident that Davis' mind was not on the work of the naturalist, for he began asking questions as to the steam-engine on wheels that he had only caught a glimpse of as he passed through the ante-room. My uncle took him back into the shop, and while removing some trumpery, to get a better view of the model, my Uncle Franklin came in and was much amused at Davis' eagerness and the questions he asked about it. He explained the model, and gave its history as being the joint work of his father, Chas. Wilson Peale and Oliver Evans to produce a traction engine for agricultural purposes. I do not recollect that any date was named; I somehow got the impression that it was about the time that Oliver Evans moved the dredging scow from the works to the Schuylkill river by steam-power; this was in the year 1804. I cannot look back to a time that I did not know this model, for when a small boy I had been allowed to play with it and push it about on the floor of my grandfather's *play-shop*, as he called his, at his place near Germantown, and on one occasion I had seen it steamed up and running around in an irregular circle on a flat piece of ground, with a great propensity to turn on its side on meeting any trifling obstruction or enough steam given to accelerate its speed beyond a slow walk and to burn the fingers of the one attempting to right it. This was my experience on that occasion; it was very top-heavy.

Davis was so much interested that he asked permission to remove it to the work bench, finding it in better condition than expected; the remainder of the day, into the night, was spent in overhauling it, and the next morning, in the presence of a crowd, that soon collected, it was started from the back steps of Independence Hall (the old State House), and made the trip the length of the square to Walnut street and return to the place of starting; on the back trip it ran into the side gutter and twice turned on its side. I have no reason to doubt my uncle's statement that the miniature working model was the joint work of his father and Oliver Evans, and I cannot be far wrong in fixing its date as not later than 1805. In fact, since I commenced writing this article little circumstances as related to me by my grandfather in connection with the removal of the dredge boat from the works to the Schuylkill, its launching and its trip down the Schuylkill to the Delaware and up it to the foot of Market street on that river front, propelled by little paddle-wheels driven by the small steam-engine on board, convince me that the working model dates back to near that date, which was 1804. Previous to the death of my uncles I learned from them that at the time of the last removal of the Philadelphia Museum the model was in the store-room and in good preservation, and the supposition is that it was destroyed at the time that collection was burned. My hopes were that my Uncle Franklin, as a mechanic, had taken possession of and preserved it.

Believing that the conversation with Baldwin, on the value of vertical cylinders, and the day with the Evans and Peale working model gave the bent to Davis' mind that he worked out so successfully in his Arabia, as to make it the type of the engines that for several years effectively did the work on the Washington branch as well as the main line of the Baltimore and Ohio Railroad. It is to be hoped the company will so dispose of the Arabia that it shall be perpetually preserved.

I cannot give a detailed description of the working model, but so much that its general character can be understood. The boiler was a wrought iron mercury bottle, say about 4″ diameter and 12″ long; holes were cut in the ends and through them 1½″ inside diameter copper tube brazed to the heads, so that when placed horizontal, as it was in the model, it represented a single-flue cylinder boiler. The steam-engine was a single vertical cylinder, which was placed on a frame extending from one end of the boiler, its piston-rod connected directly to a lever beam, which had its long end journaled to a pair of straddle legs secured by rock joints to the top of the boiler; there were no guides to piston-rods, parallel bars being used instead, the connecting-rod working from the short end of the lever beam gave a longer sweep to the crank than the length of the piston stroke. The crank was central on a shaft hung on the frame that carried the steam cylinder, a fly-wheel on each end of the shaft; to the arms of these fly-wheels were deeply grooved stud pulleys, from each of which chain belts ran to corresponding pulleys of a greater diameter on the axle of the carrying or driving wheels at or near the other end of the boiler; about the center of this driving axle was a single pulley from which a chain belt ran to one on the front axle, so that all the wheels were connected and the entire weight of the engine made available for traction, with the exception of what was carried on a pair of narrow-tread and narrow-tired guide wheels; they were hung on a lever arrangement so that the driver, with his foot on a treadle, could increase or decrease the pressure on the road. These guide wheels were governed by the driver through a pinion working in a segment of a tooth wheel; on the model a screw clamp was arranged to secure the guide wheels in position as set. This was done in the case I have referred to when running in an irregular circle; the steam valves were revolving stop-cock plugs driven by bevel gearing from the crank shaft. The throttle valve was an ordinary brass stop-cock, no water feed pump; a funnel and stop-cock on top of the boiler to fill it, a stop-cock in the bottom to empty it. The boiler was first filled with hot water to heat it, this was then drawn off and it was again filled with boiling water to a taper screw plug representing a gauge cock. To generate the steam a highly heated round iron rod, nearly filling the copper flue, was thrust into it. The entire steam-engine was the Oliver Evans of as early a date as 1785. In 1786 Oliver Evans petitioned the Legislature of Pennsylvania for security in the exclusive right to his improved flour mills, and also for *steam-wagons*. In March, 1787, the act passed, but made no reference to steam wagons. In May of the same year the State Legislature of Maryland, granted him the exclusive right for fourteen years for the flour mill improvements including the *steam-wagons*. Taking these facts into consideration, together with the plan of the lever beam-engine, I think it would be safe to place this working model at an earlier date than I have.

I have referred to having seen the Arabia, on its first trial. The intimacy with Davis had been kept up from the time of his first visit to Philadelphia, and before he commenced building the Arabia he showed me his drawings. I chanced to be passing through Baltimore and stopped over to see Mr. Davis, and found him at the shops steaming up the Arabia for its first trial on the road, and I then rode with him on its open platform, for it was before the day of cabs. He spent the evening with me in Baltimore, and I have a very distinct recollection of many of the reasons he gave for having adopted the style of engine. In the first place he had a light strap railroad to deal with, with many short curves; he must have weight to give adhesion; he must turn the curves without danger of running off, and



GEAR-CUTTING ATTACHMENT.

with the least possible friction; to accomplish this the bearing on the road must be short; three-foot wheels, close together, met this; to carry the weight central, the upright boiler became a necessity. Trucks, if they had been conceived of, had not been successfully tried within his knowledge. Six tons at that time was the utmost admissible weight on four driving wheels; he was more than doubling this, and was afraid to take direct hold of the driving axle by crank; hat no counterbalancing could prevent injurious hammering on the light rails. He believed this was greatly neutralized by the independent crank-shaft; the strain being within the machine, he did not think it would be injuriously transmitted through the cog-wheels. He considered the independent crank-shaft much safer than a carrying axle cranked; the outside connection of one pair of wheels to the other could be counterbalanced. He did not calculate on fast running. That he said was further along. The problem he had to solve was an effective engine on light rails and short curves; the time would come when both these would be remedied. He certainly did produce the first effective engine on the Baltimore and Ohio Railroad, more than answering his own expectations. It for years drew the passenger trains on both the main road and the Washington branch, and was the model from which many others were built, and successfully lifted the company out of a state of great depression. I hav heard Mr. B. H. Latrobe say that th Arabia never met with but one serious accident, and that caused the death of its designer and constructor. It was but a few days after our last evening together that the sad accident occurred. Mr. Davis was treating the workmen of the Mount Clare shops, with their families, to a trip to Washington and return. The road was then only opened as far as Bladensburg, from there to Washington in coaches. The trip was made, they dined in Washington, and on the return, when within fourteen miles of Baltimore, the engine left the track, turned on its side, killing Mr. Davis who was sitting on the platform; no one else was hurt. I believe the cause of the engine leaving the track was never discovered. By this one accident the world lost a mechanic who had proved himself to have been in advance of the age, and whose name should be remembered among the original men of the time, and a man who, had he lived, would not have been left behind in the race. It is to be hoped that the Arabia will be perpetually preserved as an undying monument to his memory. No one can overestimate the value of the preservation of early efforts in all branches of mechanical and civil engineering, relics, as landmarks in progress. I cannot better close this paper than by a quotation from a letter recently received from a well-known engineer, W. W. Evans, on the subject of preservation of models; he says: "No one knows the value of models of useful inventions until many years after they are made. John Stevens' first screw propeller, with its engine and boiler as it stands in the Stevens Institute, at Hoboken, is to me a most interesting and invaluable model, and so would be the little locomotive made by Peter Cooper, if it had been preserved, as I understand that it actually did more when tried in proportion to weight and dimensions than did the celebrated Rocket of Stephenson, which engine, now standing in the Patent Office in England, I go to see every time I go to England, and also to see another engine standing by it called Puffing Billy, which engine preceded the Rocket, in time, eighteen years. I take people to see it so they can judge of the improvements we have made in seventy-three years, as Puffing Billy was built in 1812. Its axles have square ends, and the driving wheels are fastened on with wooden wedges; the frame is made of wood, and it is trued up only at such spots where an attachment was to be made; it is a 'rummey' looking affair, but it is very interesting to see it and then turn to the very splendid machines of the present day."

Palmer's Gear-cutting Attachment.

This is a device to be attached to the tool carriage of a lathe for cutting spur, bevel and miter gears. It has a taper hole in the sliding head to take the spindle for blanks to be cut; the cutters run on a mandrel between the lathe centers.

The head of attachment has a vertical adjustment of four inches, which is operated by a square-threaded screw.

Two index plates are furnished with each machine, also an index card. It can, in addition to gear-cutting, be used for laying out cutters, marking and spacing, and for various other purposes.

It is recommended for use in shops that cannot afford an expensive gear-cutter, also in tool-rooms.

The manufacturer is J. C. Palmer, 801 Union street, Philadelphia.

In the reference to the Stiles & Parker Press Co., in our issue of January 3, the printers made us say "center-swing"; it should have been "central swing"; also the reading should have been "blank holder" instead of "block holder."

We take pleasure in noting that our valued contributor, John J. Bingley, has received the appointment of inspector of locomotives of the Chesapeake and Ohio Railway Company, and will hereafter make his headquarters at Richmond, Va.

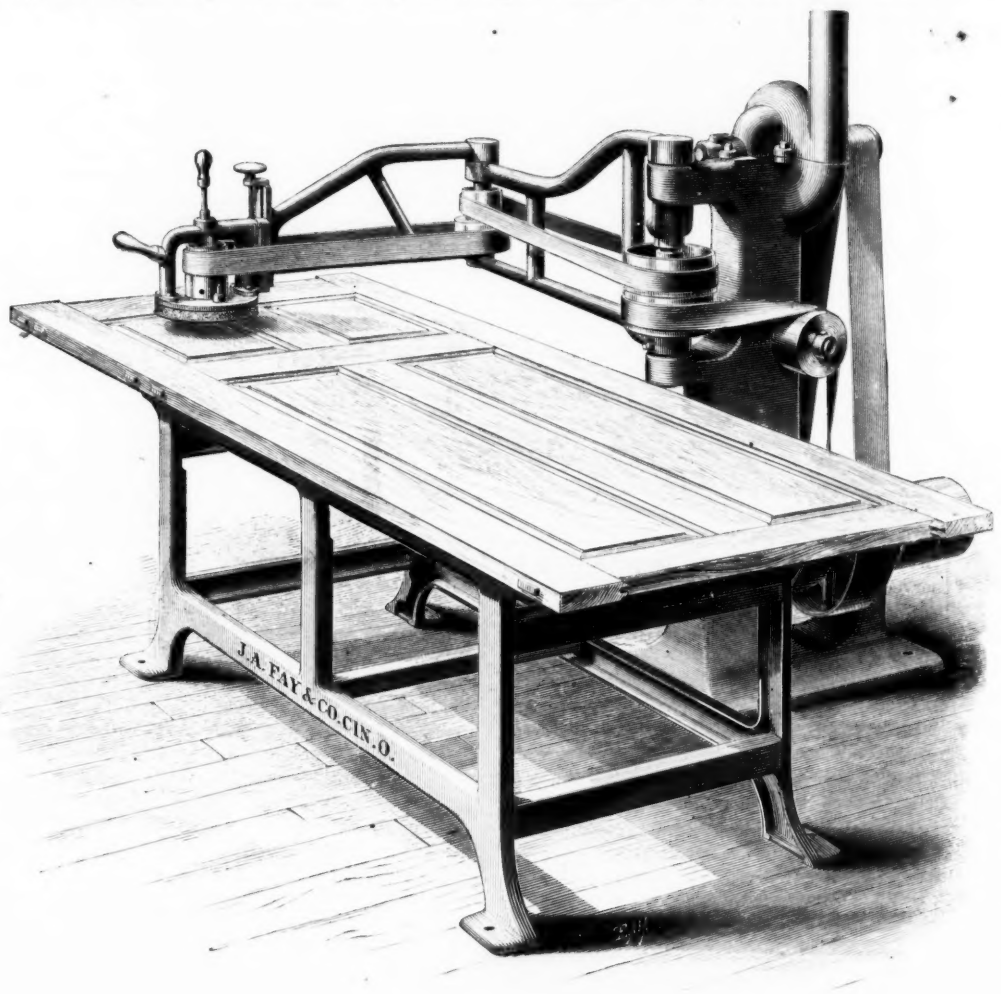
Column Sand-papering Machine.

This machine is intended for use in carpenter shops, for finishing doors, blinds, sash, etc., and in car, cabinet, piano, or other manufactories, where large surfaces are to be finished. It is constructed with a number of elbows, making it flexible in any direction, thus fitting it for finishing surfaces of large area.

The finishing is done by a disk of sand-paper attached to a head-stock; this is revolved at the proper speed, and moved by the operator in any desired direction: it produces a flat, smooth surface without tearing or breaking the corners.

The table has a fixed top, the adjustment for different thicknesses being obtained by raising or lowering the movable end of arm by means of the hand-wheel and screw. The flexible arms are attached to a column, which can be placed in any desired position in the factory, the tight and loose pulleys being arranged for belting directly from line shaft. An exhaust fan is in the column, driven from the countershaft. This draws off all dust from the surface of the work, keeping it clean for the inspection of the operator. The tight and loose pulleys are 8 inches in diameter, 4 inches face, and should make 800 revolutions per minute.

The manufacturers are J. A. Fay & Co., Cinninnati, Ohio.



SAND PAPERING MACHINE.

Estimating Weight of Ornamental Light Castings from Wooden Patterns.

At the January meeting of the Civil Engineers' Club, of Cleveland, Mr. Joseph L. Gobeille read a very interesting paper entitled, "Engineering and Mechanical Problems Relating to Stove Construction." One of the interesting features presented was his mode for estimating weight of ornamental castings from the weight of the "master" or wooden pattern. Mr. Gobeille said: "In estimating the weight of a cook-stove from the wood patterns, the ordinary practice is to weigh the patterns, allowing a pound of iron for each ounce indicated, and adding thereto 10 per cent. This method is fairly accurate with patterns made entirely of wood; but take an oven door, after it is ornamented, and there are other materials to account for, such as composition, varnish, and very often lead, if the ornamentation be heavy and bold. Estimating weight by this formula, on such a pattern, is like looking at the sun to tell the time of day. You will make a close guess, perhaps, but it will be only a guess. To get accurately at the solution of such problems, I made a tank 24 by 36 inches and 12 inches deep, and for three inches of the top I graduated a scale into 1-16th inches. This was leveled up and filled with water to the lower lines of the scale. The pattern, well varnished, was plunged into this tank for a moment, the displacement noted, then taken out and wiped off. If the reading of the scale showed a rise of one-eighth inch, then I knew that the casting, under ordinary circumstances, would weigh thirty-one pounds when set up in the finished stove. The constancy and accuracy of this method are marvelous, and have been a source of wonder to many foundrymen to whom I showed my simple expedient for the first time."

[We are indebted to Thomas D. West for the above excellent extract from Mr. Gobeille's paper.]

A valued contributor sends us a circumstantial account, for the accuracy of which he is prepared to vouch, of a recent case, which goes to show that integrity is a quality quite as valuable in the machine shop as in any other kind of business. The superintendent of a shop and general manager of a manufacturing company lost his place through the detection of an attempt to cheat a machinist out of a fortnight's pay. The cheat consisted in abstracting the plus and minus gauge, the production of which would have shown the machinist to be in the right. Curiously enough, the missing gauge fell from the superintendent's pocket in open court, at the very moment when the jury were being charged in favor of his theory that the missing gauge must have been destroyed by the machinist.

Locomotive Engineers' Certificates.

A writer in the *Railway Review* (English) writes as follows on this subject:

At the present time the question of drivers' certificates is occupying the attention of the men employed in the locomotive department of our Scottish railways, more especially the drivers, and various are the opinions expressed by them. Many of the drivers are "dead nuts" against the very idea of a certificate; others, again, express themselves decidedly in favor of a certificate for practical efficiency, while others go in for certificates "right away." Such are the opinions of the drivers when talking with their mates on the subject; but, if I am not mistaken, none of them have yet ventured to express their opinions in the columns of the *Railway Review*, where they would have publicity, and would be the means of drawing forth the opinions of many of their mates on the footplate. Why should our Scottish drivers and firemen be behind their English brethren in putting forward their opinions on the certificate question through the medium of this journal, whose pages are open to all? If you don't give vent to your opinions now, you may learn to do so when it is too late; for, depend upon it, the Drivers' Certificate Bill will, to a very great extent, be formed in accordance with the expressed opinion of the majority of the men. I am sorry to see that the firemen are not taking such a lively interest in this question as they ought to do, seeing that it is one of paramount importance to them. It seems to me that they either do not thoroughly realize the situation they are placed in, or, in their sleepy indifference, they are content to pass their days and nights on a smouldering volcano, without making any effort to escape. If they were called upon to pass both a practical and theoretical examination for the situation of a driver, how many of them would be able to do so? My own opinion about certificates for drivers is, that, in the interests of the men and the traveling public, a certificate of practical efficiency ought to be held by every man in charge of an engine, I do not believe in a theoretical examination, for all the theory in the world will never make a man an engine-driver. "Engine-drivers," to quote the words of a famous engineer, "are not made; they must be born. All the training in the world will not make an incapable man a good driver. What is known as a 'heavy hand' is an incurable failing, while lack of judgment—the most important of all qualities required—is irremediable. Engine-driving is a passion which many men who were destined never to handle the regulator have felt. To stand on the footplate with the knowledge of the vast power that is at one's command, and to know how to use that knowledge; to understand the strong and the weak points in one's engine, and be able to work on them to the best advantage; to obtain a maximum of speed at the smallest possible outlay of coal; to 'nurse' the vast machine so as to get the best results—in short, all those qualities which are only to be got by experience, study and constant observation, are the attributes of the man who has reached the top of the tree, and is entrusted with the conduct of the express and mail trains on our principal railway systems."

From the above it seems probable that a law to the effect named is soon to govern the British railroads. It may be a good thing there; it possibly might be a good thing here; but the thought occurs: Who is to examine locomotive engineers for the granting of certificates? We do not well see how such examination can be much more than what the writer characterizes as "theoretical," unless it comes through the railway officials or the man's acquaintances.

The efficiency of a locomotive engineer lies mainly in his ability to meet emergencies; and this is something understood only by those who know by experience what he does at these times. It is not probable that any sort of examination could bring his character out in this respect. It is something he could not tell much about, if he would; and the probability that he would act, in an emergency, just as he would plan to do in his quiet moments, would be in doubt. Of course he should have clear ideas of what he would do in certain contingencies; but what is this but his theory in the matter? And how often would he find that everything occurred just as he had planned for it to do? The routine duties—the fair-weather work—of a locomotive engineer are learned easily enough, and from an intimate knowledge of his character an opinion might be formed of what kind of a man he would be in a time when instantaneous thought and action were necessary. But exactly what he would do can only be known when the time of trial comes. Not that it would be necessary for an engineer to be confronted with some great impending disaster to form a reasonable opinion of his ability to meet it; but that a good deal must be known of the way he meets little troubles before such an opinion will be of much value. Who except those acquainted with his every-day work are competent to judge in the matter?

Trade With Brazil.

The following extract from a correspondent of the *Tribune* ought to be of interest to manufacturers and merchants. It is undoubtedly truthful:

"There is nothing the Brazilians desire more than intimate relations with the United States. The harbors of the empire are crowded with the steamships of England and France, and the products of those two countries are sold everywhere. Everywhere there are agents of English and French firms. If a Brazilian wants to buy machinery or cotton goods, he can find in Rio de Janeiro, Para, Pernambuco or Santos agents who will take his order and get the articles from Europe for him. But if he wants American machinery or cotton goods, he must take a long journey to the States to get them. Attempts have been made from time to time by American merchants to get control of the markets of Brazil, but they have gone about it without considering at all the requirements of the trade. They have gone about introducing their wares into the markets of the empire in the same manner that they would go about introducing them into the markets of Missouri or California, and the consequence is that they have withdrawn from the attempt disgusted and indignant. Again, they have sometimes sent out irresponsible men, who went on a junketing expedition with their employers' money and did nothing else.

"The custom laws of Brazil are vexatious in the extreme, the Brazilians being great sticklers for details in such matters. But if shippers would use care and patience, the laws would not be troublesome. The dashing, hail-fellow-well-met, carry-a-place-by-storm drummer, whose sales in Western cities make his employers rub their hands in glee, is not the sort of a fellow for Brazil. The Brazilians loll in hammocks under rustling palm trees through drowsy afternoons 'in a land where it seemeth always afternoon.' They greet each other with embraces and kisses, and drive sharp bargains with a languid urbanity that is truly charming. I believe a Brazilian would cheat a man out of his last cent, and leave him with the impression that he had been most highly honored. The drummer who succeeds here must be as polite as Chesterfield, as persistent as an office-seeker, as calm as a statue, and as sharp as a needle."

Safety Appliances in Railroading.

Experience in British railroading goes far to show that railroads are slow to adopt safety appliances until they are forced upon them by public opinion or legislation. What is true in Britain is true to a greater or less extent in this country. It seems sometimes to be, in the opinion of railroad managers, cheaper to pay for avoidable accidents than to adopt appliances to prevent them. Just here is where legislation should come in with its saving work. Railroading should not be hampered with foolish legislation, but the public has certain rights that can be secured in no other way either in this country or in England. Such legislation should be entered upon with great circumspection, but it is within reasonable limits absolutely necessary. Very generally it is a relief rather than otherwise to railroad corporations.

A Heating Coincidence.

In our issue of December 19, 1885, under the heading, "One Way of Warming a Factory" we published the following editorial paragraph:

Not long since in building a new chimney for boilers, the chimney was built round and thus without corners to retard the draught. No brick core was used, but a cast-iron pipe, cast in sections, was set in for a core, and a space of 6″ left for an air space, open to the air outside the chimney. The air space was closed at top of chimney, 16″ tin piping being laid from the third story of the factory to the air space. Notwithstanding numerous predictions that the draught would be spoiled, the third story and part of the fourth in that factory are now warmed from the air space in the chimney.

We find the following in the *Scientific American* of January 16, 1886. The voice appears to be the voice of Jacob, but the hand is evidently the hand of Esau. The paragraph is published without credit of any kind, under the heading, "Cheap Method of Warming Factories":

It frequently happens that chimneys are now built round, without corners to retard the draught. This is done by inserting in the chimney, as the building progresses, cores consisting of iron pipes cast in sections, or tile piping. Air spaces are thus left between the core of the chimney and the outer wall, and of course the air in this space becomes heated to a high temperature. It is quite practical to utilize this air for heating purposes, if this is found desirable. The air spaces being closed at the top, and openings being made to the open air at the base of the chimney, tin piping is connected with the spaces for conducting the heat to different parts of the factory. Of course, this method is not designed for heating the stories nearest the ground, as the current of air in ascending has not had sufficient exposure to become heated until it has reached the third or fourth story of the building.

Boiler Tube Expander.

This tool is of the Dudgeon type; the rollers and mandrel are of tool steel; the body is of tool steel, end-plate and screws are machinery steel; the collar and guard are steel castings. The guard is cut away on both sides, as shown in cut, and does not revolve with the tool. The screws in end-plates are cut with fine thread and fitted closely; this prevents them from working loose in using the tool. The heads of screws are carefully hardened, so as to hold their shape from use of wrench or screw-driver. The larger sizes are made with hexagon heads, and small sizes are slotted for screw-driver.

The manufacturer is C. S. Knight, Selma, Ala.

Improved Erecting Table.

A recent issue of *Engineering*, in an article describing the engines of the S. S. Enfield, gives an illustrated description, which we reproduce, of an improved "erecting table," which was built expressly for the Enfield engines, by the Central Marine Engineering Company, West Hartlepool, England.

"In the floor of the erecting shop thirty-two piles, twelve inches square, were driven down into a solid stratum of clay, and on these a thick bed of concrete was laid, producing a foundation which no weights that are likely to be put upon it, will ever disturb.

"On this foundation four cast-iron girders were well bolted, the bolts reaching through the concrete. These girders have planed T grooves in the direction of their length, and upon them were placed four wide girders, planed on the underside, to slide upon the lower girders, and arranged to be secured thereto at any point, by bolts in the T grooves. The upper sides of the upper girders have planed T grooves at right angles to their length, and their upper surfaces are planed all over. Both sets of girders were set absolutely level by the careful use of a very expensive and heavy, sixteen-feet straight-edge and a delicate spirit level. Our engraving, Fig. 4, annexed, shows a perspective view of the completed arrangement, which the builders call an "erecting table."

"The bedplate of the engines is planed on the underside, and it is obvious that when it is placed upon the level-erecting table, its upper surfaces will be level without any straining of its members by wedging at any part. The foundation of the erecting-table is so rigid and unyielding that the readings of spirit-levels may be confidently relied on to the very top of the engine, no matter what weight has been piled on.

"When the engine is placed upon the table, a large and very powerful boring apparatus, specially designed for the purpose, is fixed upon the lower tier of girders at one end, and a strong "stay," which is provided with up-and-down and sideways screw-adjustments is placed between every pair of main bearings. In these is set, by a delicate spirit-level, an 8½-inch solid steel boring bar, about twenty-seven feet long, and by means of boring heads and arbor rests, all the main bearings are bored at one time, and faced down the sides. This plan insures absolute truth of alignment of the main bearings, whilst the bedplate is freely resting upon a level surface, and the engine is not again disturbed, until completely erected. Certain planed projections are put on the bedplate to enable the engine to be re-erected on board ship, in precisely the same condition as that in which it stood when bored on the erecting table.

"The system has another advantage in that, when completed, the engines can be bolted to the upper tier of girders, and steamed in the shop, before leaving the hands of the erector. This was done in the case of the engines of the Enfield, the steam being suppied by the factory boilers, and the injection water drawn from the dock adjacent to the works. This system, expensive as it doubtless is in first cost, has proved highly satisfactory, and offers many obvious advantages."

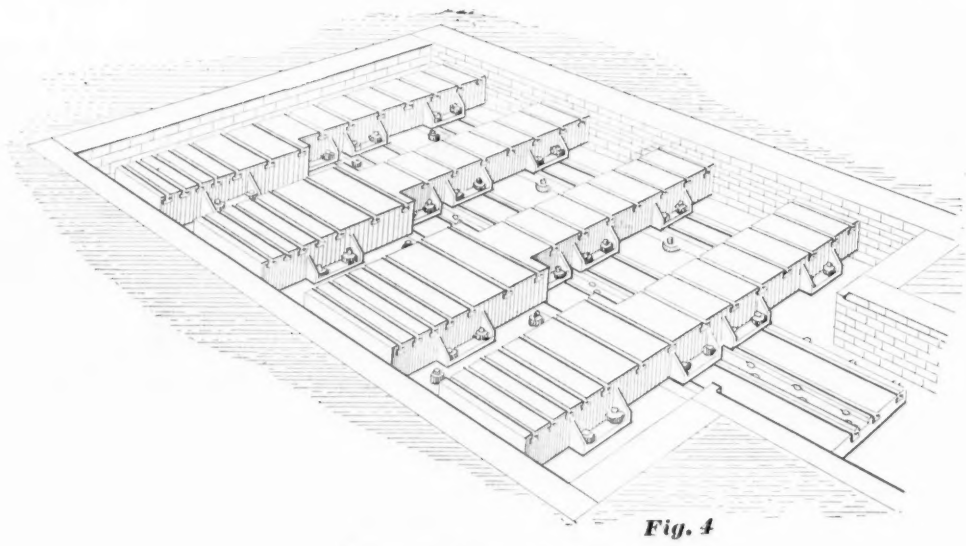


Fig. 4

IMPROVED ERECTING TABLE.

According to a cable dispatch in the *New York Times*: "The great steel manufacturer, Marshall, of Sheffield, is about to remove his entire works to America. The firm employ 3,000 men. Some scores of the most skilled will be taken over, and the rest will be hired in America."

If the above be true, it speaks well of the value of protection as compared to England's free trade.

Our native manufacturers may not feel like welcoming such a competitor as Marshall to this country, but it may be regarded as a striking proof of foreign confidence in the results and the reality of the American business revival.

The Mexican Government has in contemplation the establishment of a permanent industrial exhibition at the city of Mexico. The Government refuses to allow the matter to be managed by any outsiders as a money-making scheme.

LETTERS FROM PRACTICAL MEN.

Efficiency of Gear Teeth, Again.

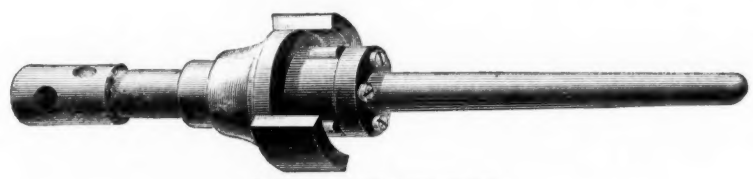
Editor American Machinist:

Mr. C. A. Smith, in the AMERICAN MACHINIST of January 16, criticises three of my articles with great freedom, as is proper, but in great haste, which is not proper in print.

He calls attention to "certain discrepancies," which are due only to his hurried examination of the matter.

1. My paper on the efficiency of gear-teeth related only to the work done by the friction of teeth on each other, and, of course, I did not refer to journal friction, or other irrelevant matters.

The *actual work* done by gear-teeth, or by journal friction, is a matter that can, probably, be handled by experimental methods only, for analysis can but lay down the general principles.



BOILER TUBE EXPANDER.

But the *comparative work* done—the work done by one form of tooth, as compared with that done by another, is not a subject for experiment. Analysis shows that actual values are so close, whatever they may be, that experiment would not detect their difference.

The chief point made in my paper was that the involute really has the advantage of the epicycloid in the matter of efficiency, in spite of the fact that the decided contrary is claimed by certain advocates of the latter curve. I sought to show that the matter of comparative value could not be decided by considerations of efficiency, leaving the comparison open on other points.

Either analysis or experiment, applied to journal friction, would show the two curves to be practically equal. At half a tooth distance on either side from the pitch point, they give exactly the same thrust on the bearings, and in the same direction; within that limit the epicycloid has the advantage, and outside of it the involute leads. It would take some close work to determine which would lead on the average, or as to the total, and that average or total is most probably a little in favor of the involute. The work done by friction of journals is dependent almost wholly on the main work or power carried. The additional friction on journal, due to side-thrust of teeth of any form, is very small.

My only effort, in dealing with efficiency, has been to show that the popular idea that the epicycloid is much the best form of tooth, is a prejudice.

I dispute Mr. Smith's statement that "the journal pressure *does depend largely upon the form of tooth adopted.*" There is more fancy than fact in the worship of the epicycloid.

2. My statement concerning the shaping of bevel-gears was correct, and by no means novel or original with myself.

Mr. Smith says that the angle of face is independent of the diameter, which is not a fact. If you reduce the diameter, you increase the face angle, unless you change the pitch at the same time. If he had looked twice, he would have seen that my statement related to *correcting blunders*, and not to original designing. If a false cut is made on the pinion, much more must be cut from the gear, and if much is taken from the diameter, the face is spoiled. The face can be saved only by changing the pitch, the proportion and number of teeth. This is a very common matter in practice, and the usual resort is to stunt the pinion teeth, as the least objectionable correction. What does Mr. Smith mean by "tools for sizing bevel-gears?" I should be pleased to get hold of something new in that line. My men use brains for that purpose, with the assistance of common tools to be found in any well appointed shop.

Boston, Mass. GEO. B. GRANT.

Truing Milling-machine Centers—Another Way.

Editor American Machinist:

The article by A. B. Landis, in the AMERICAN MACHINIST of January 16th, on truing-up milling-machine centers, reminds me of a plan which I have used with satisfaction in a number of cases, and thinking it may be of use to some one, I will explain how I did it.

I was not allowed to make any special rigging, so I finally hit on the following plan:

The machine was a small Brown & Sharpe universal, and I had to work with their plain grinder. My first operation was to grind the center in the revolving head, as nicely as I could. Next, I soldered a small piece of brass on the point of the tail center, and after making sure that the head and tail stocks fitted the plates nicely, I brought them together, till I made a small mark, like that of a center-punch, in the brass soldered to tail center. Then I took out the tail center, and bolted it to a small angle-iron, and this to the face-plate of the grinder. By the aid of a center indicator, I got the mark in the piece of brass to run *very nearly true*. Then grinding to the proper angle, and replacing in the machine, and testing it for truth, I had a job that surprised those who were in charge.

If care is taken in these operations, the result will be practically perfect, although, theoretically, the method is not as reliable as the one described by Mr. Landis.

GEO. W. DRURY.

Springfield, Ohio.

Cheap Testing Machine.

Editor American Machinist:

In a recent issue of the AMERICAN MACHINIST was an article in regard to machines for testing iron, and it seemed to me that some of your readers might be interested in learning how to make a good testing rig, at an expense of not more than twenty-five cents.

Having an ordinary platform scale, mounted on wheels, I drilled a ¾-inch hole through the center of the platform; then made an eye-bolt of ⅝-inch round iron, with the eye about 1½ inch diameter. The bolt was long enough to have the nut on top of the platform, and the eye reach down low enough to admit the test piece through it underneath the frame of the scale. One person can slowly screw down the nut, while another slides the poise and adds the weights to the scale beam. The breaking strain can always be ascertained very correctly.

In my case the frame of the scale was 2 feet wide, thus making the bearing points of the test strip just 24 inches apart. The pieces were cast 25 inches long, about 1 inch square and rounded in the middle. This round part was afterwards turned for an inch in length to a diameter of .798 of an inch, making the area ½ inch. This was done to make the sizes exactly uniform and of convenient dimensions for calculation of the tensile strength. Quite a number of pieces of these

dimensions, cast of various mixtures and at various intervals, showed transverse breaking strains running from 320 to 478 pounds, and some of the results were quite unexpected; as some vaunted brands fell below other specimens which were supposed to be quite inferior.

The results are so accurate, and the process so simple and cheap, that no foundry can afford to depend on guess work or the representations of pig-iron salesmen, to know the strength of various brands of iron, and the effects produced by different mixtures and conditions of melting and casting.

WILLIAM MERRILL.

East Saginaw, Mich.

Moulders' Sand Dampener.

Editor American Machinist:

This device has been in use here for years, and is very much liked. Parts of moulds can be wet that cannot be reached by other means. Besides being more clean to use, the drip can be easily regulated from a stream to a slow drop.

The part *A* is made of a semicircle of tin of about 2¼″ radius, formed into an inverted cone. In the lower end is inserted a drip tube *C*, into the upper end of which the pointed screw stem *D* is made to raise and lower by the milled head *I*, to regulate the flow of water. A piece of needle, or sharp steel wire, soldered in lower end of tube will cause it to run a sharper stream.

The part *B* is cut 1″ wide on a radius of 3″ or 4″ The handle *G* can be used to hang it on the side of a dish. Tube *C*, stem *D*, and nut *F* are fastened in place before the rim is put on. Tube *C* is about 2½″ long; stem *D*, 2½″. A two-cent piece will make a head; the thread will need to be cut from one end of the stem to middle. Some years ago I was in a foundry where, for want of room, they would pile the moulded-up flasks some three or four feet high, placed on a jog so as to expose the sprue-hole for pouring.

In moulding up their snap-flask work they put in a loose ring at the joint of the cope to strengthen the sand when the flask was removed. In some work they would ram the cope up solid and cut the sprue with a tube slightly tapering, cutting down to the gate pattern. They also used a stamper for some work with about a 6″ face.

Waverly, Pa. H. SHERMAN.

Chattering Milling Machines.

Editor American Machinist:

A milling machine that chatters is a great annoyance, makes unsatisfactory work, and endangers the milling cutter. The deficiency in a milling machine that chatters, is, that it is not built heavy enough, especially the arbor support, as well as too long or too light an arbor; but the latter would be easily remedied in any machine. All the milling machines I have yet had anything to do with which have an overhanging supporting arm for supporting the outer end of the arbor, are not stiff and heavy enough, in this particular part, to prevent chattering when doing ordinary heavy work. Chattering can be prevented, to a great extent, by being careful not to get too much clearance to the teeth of the milling cutters; yet on this sort of a machine this will not overcome the difficulty, in doing heavy cutting.

Milling machines having a solid head for each end of the arbor, and solidly secured to the bed of the machine, are undoubtedly the best in all cases for heavy milling, being more in accordance with the construction of a lathe. We would very naturally conclude that a lathe constructed with an overhanging arm to hold the tail center, was all wrong, as it would give us no benefit of the stiff bed we have beneath it. Just so important is it in milling machines to have the arbor supports solid, to do satisfactory heavy milling. Yet the heavier types of milling machines, having the supporting arm (which are the kind I have worked with), do very well until heavy milling is reached; and then they invariably chatter. This was the experience I had in the "Gang Milling," given in your issue of Oct. 17, 1885, in which it was desirable to have a smooth job; but owing to the number of cutters and the depth cut, the duty was pretty heavy, and the chattering could not be overcome, even with little clearance to the teeth. I applied a remedy which is very simple and satisfactory, the plan of which is shown in the drawings.

Fig. 1 is the side view of a supporting arm *A* of a milling machine with the center-head *B*, as milling machines of this type are usually made.

Fig. 2 is an end view of same. When a milling machine chatters, this support is set into quick vibration. The plan I adopted, was to make a weight *C* of about 150 to 200 lbs., with an elongated hole where it goes on to the arm; slot one side of this hole on the slotter, so as to give a true and smooth surface and bear against the arm. The opposite side of this hole has a slot to receive a key, *G*, which is brought to bear against the arm by the set screw *F*. Legs of iron, *E E*, reach to the floor for supporting its weight, but instead of this, an eye, *D*, can be used and the weight suspended by means of counter weight and a rope, which after using can be moved up out of the way. The elongated slot is to prevent any weight being brought on this arm, and by hanging it plumb with said arm no side thrust is brought on it; consequently, it will hold its natural position (true) regardless of the weight. Now, it will be clear that when this weight is thus secured to the arm, that to chatter, this heavy weight would have to give the quick vibrations it had before, but owing to its weight this is impossible; the milling goes on smoothly and makes smooth work. When putting the weight on while the machine is chattering, it instantly ceases as soon as the weight is slipped over the arm.

Although this weight is not an ornament in appearance, yet it has proved valuable to the ears, as well as to the work being done. This is a cheap device and quickly made, and will many times pay its cost in a short time, where chattering has been the trouble.

A. B. LANDIS.

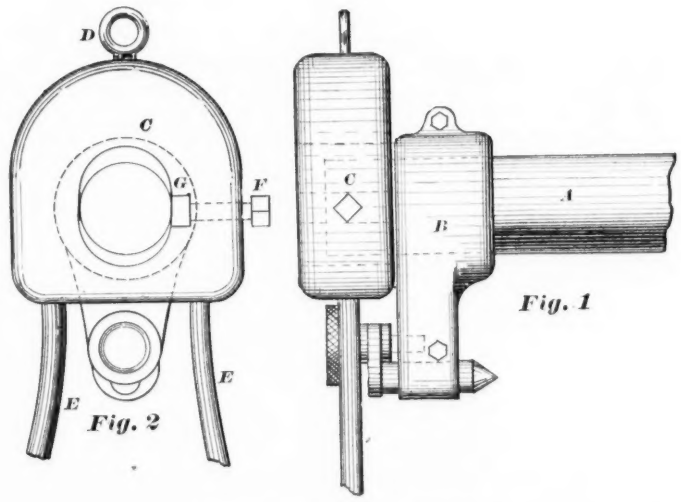


Fig. 2 Fig. 1

CHATTERING MILLING MACHINES.

Draining Steam Pipes Toward the Engine.

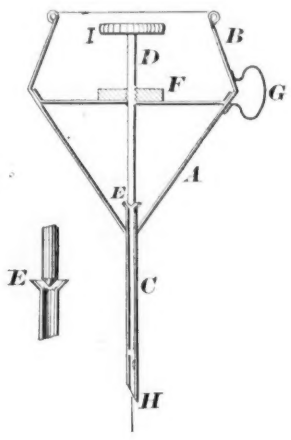
Editor American Machini st:

Your answer to E. T. M., of Reading, Pa., "Questions and Answers," No. 24, Jan. 16, instructing him to drain condensation in steam pipe toward engine, instead of boiler, is so different from my practice for years past, that I wish to ask the question, Why? I had always thought it best to make the highest part of steam pipe as near the engine as possible, believing it to be better economy to return the water to boiler, and also more convenient in starting the engine.

S. C.

[Different opinions are held on this question by engineers. Our reasons are: When the steam pipe trends downward, *toward* the boiler, the movement of water of condensation is retarded by the flow of steam in an opposite direction. This being the case when the engine is cutting off short, and using a small amount of steam, the load on the engine may be suddenly increased, the point of cut-off advanced, and a sudden rush of steam occur, to fill the additional requirements of the engine. In this case much of the water which has been held in the steam pipe, by the advancing steam is suddenly carried over, into the cylinder, by the above mentioned rush of steam; consequently, the cylinder gets more water than can be accommodated without risk to the cylinder head or connecting-rod.

When the steam pipe is drained *toward* the engine, water of condensation is helped along by the flow of steam, and is gradually discharged, without trouble or delay, by means of a trap, or other suitable contrivance, placed in connection with elbow or tie, near the steam-chest. In one instance, at least, the experiment has been tried of connecting the above mentioned drip direct with the



SAND DAMPENER.

boiler, below the water line, by means of a small pipe and check-valve. In this case, it is needless to remark that the engine was above the level of the water line in the boiler.]

Draining More Steam Pipes.

Editor American Machinist:

In the AMERICAN MACHINIST of January 16th, the question (No. 24) was asked whether a steam pipe should drain towards the engine or boiler, and the answer was, "towards the engine." In the writer's experience an engine and boilers were set up with the intention of draining towards boilers, but the roof of the boiler-house was too low, and the main pipe had to be put up so that the pipes from boilers should go in at the top instead of bottom, necessitating the draining towards the engine. The main pipe was 8″ inside diameter; supplying a 28″x60″ engine of the Corliss style. A ½″ pipe was used to drain from near the throttle, but even though this was opened wide before starting, when the throttle valve was opened to get the engine up to speed, a large amount of water would come from some place in the pipe, and not infrequently the valve would have to be partially closed to check the too rapid flow. This operation was always gone through with when starting the engine. When building new shops more power was required, a new boiler-house was built, and all the boilers put in it.

A 30″x60″ Corliss engine was put in the new mill, requiring a pipe over 200 feet long from the main pipe in boiler-house. This pipe was drained towards the boilers, and there was never any trouble from water. The 28″x60″ was connected to main pipe in boiler-house, but drained towards engine the same as formerly, and the same trouble from water continued. The pipe to this engine was changed so as to drain towards boilers, and the trouble from water immediately ceased. In correspondence with an engineer on this subject, he mentioned a case in his experience, where he had an engine with small clearance and pipe inclined towards boiler. The engine had an irregular load and, after running light for a time, then having a load thrown on, there would be a snapping in the cylinder, which he attributed to water loafing along in the pipe during the slow flow of steam, and then being rushed along suddenly when the flow was accelerated by the larger load. I had the same experience with light and heavy loads, with pipe inclined towards engine; but had attributed the cause to the cooling of the cylinder from the low mean pressure, and the rapid condensation when the mean pressure was raised.

W. E. CRANE.

Waterbury, Jan. 18th, 1886.

Thinking and Observing.

Editor American Machinist:

While reading Mr. Hobart's article on Confidence, and Mr. Goodyear's on Thinking and Unthinking Men, it occurs to me that next to the thinking man comes the observing man; the man that is able to see a thing that is worth remembering, be it in the daily paper, a "Shop Kink," or an idea advanced by himself or some of his shop mates; see it and make a note of it for future reference.

Observing without noting is like having a tool room without a keeper; some valuable idea may get lost. The idea of noting observations was strongly brought to my notice by an apprentice in a down East shop. While jogging around the docks one holiday we were watching some men lifting the spars into a new ship; he made the remark, "What a simple hitch." And with that he drew a book and pencil from his pocket and made a sketch of that hitch. I at once adopted his plan, and have followed it since. It is very useful as well as amusing and instructive. Follow this for one year and you will find that you have struck something that will pan out better than expected. P. L.

Lining an Engine With a Fish Line—A Crown Sheet Comes Down.

Editor American Machinist:

I want to tell how a 100 horse-power Corliss engine was "lined up" with a two-foot rule and a fish line.

First, the main journal got hot, and melted the babbitt in top and side gibs, and some in the bottom. The engineer was ordered by the proprietor to take out the old babbitt, and, when he got ready to line up the engine, to call in the proprietor, as "he had had a great deal of experience with such things." When they came to the babbitt under the shaft, it had not been melted very much, so it was decided to leave the bottom box as it was, after finding the crank-shaft was level, which was done by hanging a punch on the end of a line dropped from the roof, and coming within about ¾″ of the collar of crank-pin. The crank was then turned to the top quarter, and the proprietor squinted through between the line and collar on crank-pin—¾″ apart. Then the crank was placed on bottom quarter; he squinted again, and it was decided that the shaft was level. As the babbitt underneath need not be touched, it "didn't matter how much the shaft had gone down bodily, as long as it was level."

A wooden pattern was made, about as big as one-half the shaft, and having *about* the same radius, and the top and side gibs were babbitted on the wooden pattern. When done, they had too large a curve to fit the shaft, but were scraped down to something like a bearing and put in. Then the proprietor proceeded to "line up the shaft." A fish line was stretched from the side of the piston gland, past the crosshead and past the crank. (Hadn't time to put the line through the cylinder.) Then it was measured with a two-foot rule, to find how far the line was away from the piston-rod next the gland and out next the crosshead. It was about 6″ from the rod at each end; then the crank was placed on the forward and back centers alternately,

measured again, and it was found that the crank was about the thickness of the line *more* than 8″ from the line on one center, and about the thickness of the line *less* than 8′ on the other center. This was thought to be pretty close, and the connecting-rod was coupled to the crosshead and tried as follows: After driving the key as far as it would go, three men raised the rod, and it was found it would shake about $\frac{1}{2}$″ sideways at the crank end; the crank was placed on the front and back centers, and the three men shook on the rod sideways, and it "seemed to shake about as much one side of the crank-pin brass as the other," so it was thought it must be in pretty good line, and the engine was coupled up and started. It thumped a little on the start—ran a little warm. The wheels are still going round the same as ever, but how long the crank-pin and crosshead brasses will last remains to be seen.

I also want to tell about a little experience with a threshing engine. Said engine was a straw-burner, with fire-box, 8′ flues, and 14 three-inch return tubes. The fire-box was made about 6″ narrower at top than at bottom, the sides being straight and sloping from bottom to top. The top was a part of a circle, supposed to be a true curve from one side-sheet over to the other. It had one row of stay-bolts along the top lengthwise of the center; also a row just where the top curve joined the side. From these down, the sides were well stayed 6″ each way. The engine (a traction) was in the field at work, and had just made a move of about two rods on smooth ground, and was standing quietly, having two gauges of water in the boiler and the fire dead, with 120 pounds steam. Just as the men were about to put on the belt, a sort of "chug" was heard in the fire-box, the door was opened and it was found the crown-sheet had dropped some 3″ or 4″ along each side at the top, between the center row of stays and the rows where curve joined the sides. There it stopped, after having partly torn loose from three of the stay-bolts on one side, so as to cause quite a leak. I should like the opinion of any who may read this about how near they think we came to an invitation to come up higher; also, do they think it was simply a case of over-pressure, or should there have been more stays in the crown-sheet? The boiler was made of $\frac{1}{4}$″ iron; I could not say whether the fire-box was steel or iron. It seemed to be pretty tough, or it would not have dropped so far as it did and stop there. The sketch of the fire-box, before and after, shows how the crown-sheet came down.

REVERSE GEAR.

Cylinder Packing.

Editor American Machinist:

I read Mr. Bingley's article in the AMERICAN MACHINIST of January 16, about packing, and I feel like saying a few words of approval. I don't know Mr. Bingley or what road he represents, but I do know that he has got *the* packing. For years I didn't want to believe it, but am forced to acknowledge that it goes ahead of anything I have met. It has the three elements of simplicity, cheapness and durability. I could tell of some wonderful performances of this packing, but I don't believe any test that is made, which does not embrace general results, amounts to much, so I simply say that we are using it in hard service on all our engines, both passenger and freight, and it is doing good service, I might say perfect, but that is a word that needs to be qualified under most circumstances.

We fit it up the same as Mr. Bingley does save in one or two particulars. We use no dowel at all, simply put the rings in, bolt on the follower and let it go. In all probability it will not be looked at for months. We also fit the bull ring so that it fits the lugs of the spider loosely, but do not give it any clearance. We never line it out; it don't pay. A new bull ring is not worth over two or three dollars, and with the packing rings worth 75 cents, it is not worth while to bother much with the old ones.

Mr. Bingley is right about making joints where the rings come together. It is not needed. By all means keep everything out of a cylinder you can, excepting steam.

As for wear of cylinder, it is no more than other packing that has come under my notice.

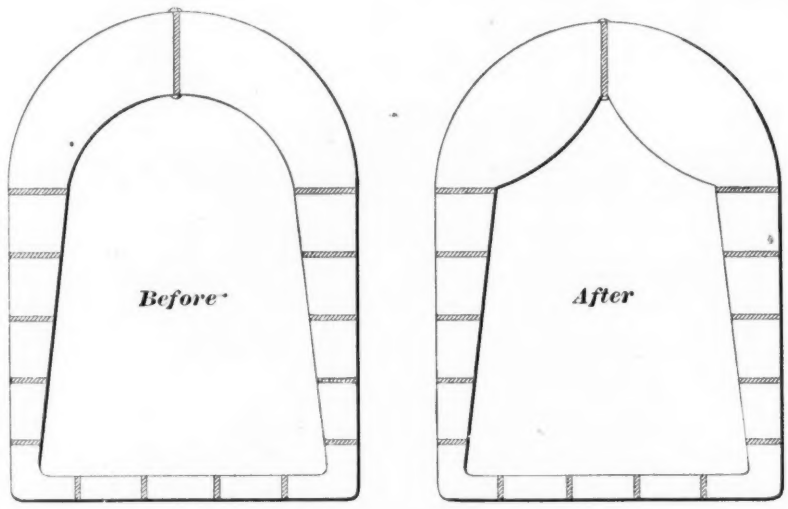
ENGINEER.

Blowing off Boilers—Closing Valves.

Editor American Machinist:

J. E. M., in your issue of Jan. 23, is quite right in his criticism of "Rules for Engineers and Firemen."

Some engineers claim that in the morning, just after getting a little steam, is the best time to blow out. We all know that when a boiler stands over night, or even for an hour or two, the sediment settles to the bottom. So the facts are, when the fires are started the water begins to circulate, and when you have steam, all the sediment is mixed with the water, and if the boiler is blown out then, the largest portion of sediment is left in the boiler, because while steam is raising, and the fires burning strong, a great deal of the sediment floats on top of the water. If the boiler is blown out while steam is up, it is better to have a high pressure.



A BAD CROWN SHEET.

It is a common practice among most engineers, when closing a valve, to screw it down until it seats itself, and then they will tighten on it more, as though they intended to twist it off somewhere. Now, no good engineer will do this. If a valve leaks when it is seated, he will not try to stop it by tightening more, but he will take it out and grind it.

W. S. HOFFMAN.

Morgantown, W. Va.

Size of Steam Ports Adapted to Link-motion.

Editor American Machinist:

There are many who raise objections to the shifting link-motion, as used on American locomotives, whose objections are more fanciful than real, in nine out of every ten cases, and who charge much of the behavior of an engine to the valve gear. If the motion is designed by a competent engineer, it will give a very good distribution of steam, so far as the link-motion proper is concerned. In making comparisons, it must be made with the automatic stationary practice of the day. In the opinion of the writer, the area of steam ports has much to do with the economical working of the engine. Let us see what ought to be the area of steam ports for a 17″x24″ locomotive, for a given piston speed, based on Anchincloss as authority: Speed in miles per hour, 38; driving wheels, 60″; the piston speed per minute in feet is

$$\frac{24\times38\times56}{60}=851.2.$$

The maximum flow of steam should not exceed 100 feet per second. A seventeen-inch cylinder, having an area of 226.98 square inches at the above piston speed, 851.2 feet per minute, will represent a consumption of

$$\frac{226.98}{144}\times10=15.763$$

cubic feet of steam per second, and in this proportion for any point of cut-off; and the steam-port area for this cylinder would be

$$\frac{15.763}{100}\times144=22.689+.$$

The width of port being 1.25″, the length becomes

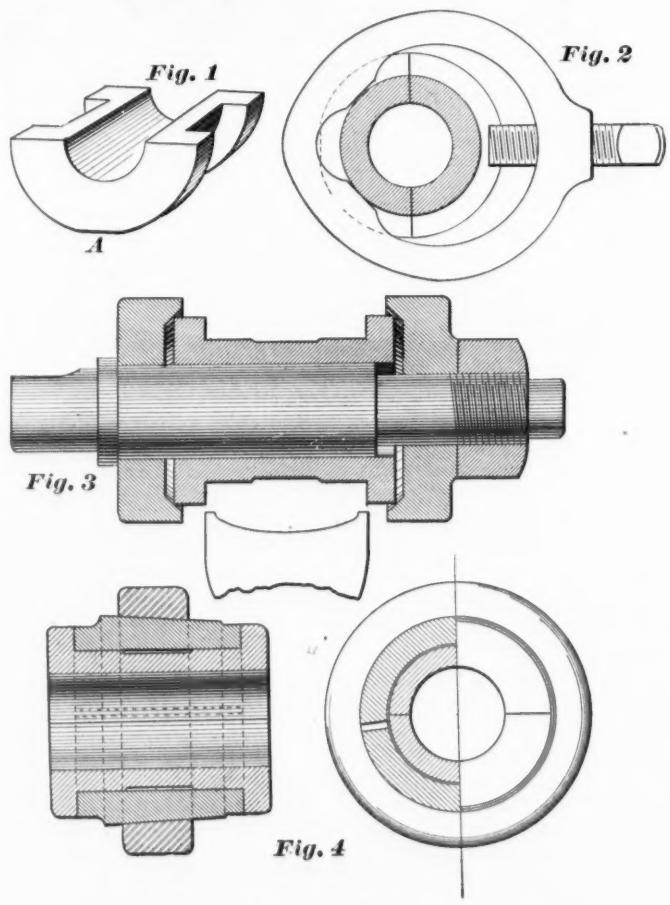
$$\frac{22.698}{1.25}=18.15$$

The area usually given an engine of this size is 18.75″. It will be seen I have taken a very fair piston speed, for passenger service. In good stationary engine practice, with which we are comparing the link-motion, the above port area would be right for about *one-half* this piston speed.

One objection offered to a longer port is, a larger valve is required; but, as there are good balanced valves on the market, which are favorably received on many roads, I see no reason why larger ports cannot be had. It need not necessarily be a long port, as the Allen valve can be designed to work on a port up to $1\frac{5}{8}$″ in width, with $\frac{7}{8}$″ outside lap, and 5″ maximum travel.

I predict the coming cylinder will be cast so as to use a false valve-seat from the start, of any desired dimensions.

RALPH E. STATE.



MAKING HALF BOXES.

"Ice in the Feed Pipes."

A press dispatch referring to a recent boiler explosion concludes: "The explosion is supposed to have been caused by ice in the feed pipes." It is possible there was ice in the feed pipe, but what had that to do with an explosion in the boiler? Ice in the pipe would have kept water from entering the boiler, but reasonable vigilance on the part of the engineer in charge would have led to a discovery of this fact before any serious consequences resulted. In about 50 per cent. of the boiler explosions we read of the cause is said to be in some way connected with a failure to get water into the boiler, as if this exonerated everyone. Why not state the exact truth and say, when there is evidence that pumps have failed to work, that the real cause was an incompetent engineer who didn't know whether he was getting water into his boiler or not, or a risky engineer who took the chances of running with low water when his feed failed; or an engineer who was expected to work all over the building, leaving his boiler, so far as safety was concerned, to the probabilities of an injector or pump continuing to work in his absence? By an exact statement of facts every time, accidents from low water would soon cease. It would come to be understood that a man, having charge of boilers must be experienced in his business, and must be left to attend to it. Such men, when so left, do not put in a plea of low water. They understand the weakness of any boiler feeder, and never take it for granted that it is working. "Ice in the feed pipes" is to them a matter of inconvenience, not of danger.

Making Cast Iron Half Boxes.

BY A. J. SHAW.

I find among my papers, sketches illustrating the tools and processes which I once used for getting out a lot of cast-iron boxes, made in halves, one of which is shown in Fig. 1 of the accompanying drawings.

The shop was a small one, without an extensive assortment of tools to draw from, and the order was not large enough to warrant the putting of any expense into the tools which could be avoided, while as the boxes were to be interchangeable, it was evident that if any approach was to be made to the requirement, some special arrangement must be made to that end.

The boxes were to fit in bored seats, so that all the work would be done on the lathe, with the exception of the joint between the two halves, which was required to be metal to metal, when the boxes were closed on the shaft, which made it impossible to make them in one piece and saw apart after turning.

On this account, the rigging up necessary was principally for the purpose of holding

the boxes together during the various operations to be performed upon them.

The first operation was to "spot" the flanges of all the boxes, as shown at *A*, Fig. 1, after which they were clamped down, with the spot *A* bedding solidly on the planer table, and the joint-faces planed to a uniform height, with a single setting of the tool.

A knee was bolted to the face-plate of a lathe, and so adjusted that the height from the face of the knee to the line of centers should be the same as from the spot *A* to the plane of the joint between the half-boxes.

In this manner, after once setting the knee, the joint would always bisect the bore of the box, without further trouble.

Each box was clamped to the knee by a stirrup bolt, which passed over it and down through the knee, at either side, and bored and reamed to size.

After reaming, the boxes were put together on a close-fitting arbor, and clamped solidly with a yoke, as shown in Fig. 2. The yoke was of cast iron, with no labor expended on it, except drilling and tapping for the set-screw.

While on this arbor, the ends were faced up, and the flanges turned on the outside; after which, the box was transferred to the arbor shown in Fig. 3, being held together by the hollow, conical collars, while the flanges were squared up on the inside, and the body turned to size.

To insure a uniform distance between the flanges, both were squared up at one operation, with a double tool, the plan of which is given in Fig. 3.

For polishing the flanges, for which a high finish was required, recourse was had to the speed-lathe and emery-stick. But as, at the speed necessary for polishing, the clamping-dog, shown in Fig. 2, would shake badly, and also be highly dangerous, the boxes were held together, for this operation, as shown in Fig. 4, which requires no explanation, except to say that the object in reducing the split ring to the exact size of the box flanges, was to protect the inner corners from being rounded over during the polishing.

The boxes were prevented from turning in their seats, by dowel-pins, and for drilling the holes for these pins, so that they would coincide, two jigs were made, one of which was a duplicate of one of the half-boxes, except that it was not bored out, and the other a half-ring fitting between the flanges of the first.

These jigs were drilled off together; the ring used for drilling the boxes, and the false box for drilling the frame.

The results obtained with the above described fixtures were very satisfactory, both as to the quality of the work and its cost; their use ensuring a uniformity which could not have been attained without fitting up, and an economy of time that, in making a dozen sets of boxes, much more than paid for the cost of the special tools employed.

Co-operation.

Co-operation between employers and employes, by which the latter shall share in the profits of the business, has long been looked upon by many as an inevitable outcome, and plans for bringing it about have been numerous. Recently the *Sun* gave pace on its editorial page to the chief features of the plan proposed by the New England Granite Works, of Westerly, R. I. The plan was worked out by the president of the company, J. G. Batterson. The *Sun* says:

His proposition is, in brief, that both capital and labor shall share in the net profit made on all the orders executed during 1886 by the company, in proportion to the amounts or values contributed by each. This net profit is to be determined by deducting from the gross receipts, first, the wages of the men employed as journeymen, which shall be paid monthly, and, secondly, the other expenses of conducting the business, superintendence, traveling expenses, clerk hire, taxes, insurance, and legal interest on the capital employed. The amount left shall then be divided into three parts, one as a dividend to labor, one as a dividend to capital, and one to be reserved as a guarantee fund, to which shall be charged all losses by bad debts, or credits given for materials and labor during the year.

The labor dividend shall be paid before any dividend is paid to capital, and the time of payment shall be at the end of the fiscal year. The statement of the net profits shall be verified by a competent accountant selected and agreed upon by the parties in interest. As the labor dividend is for labor only, no officer, superintendent, overseer, clerk, or agent will participate in it; and no workman who is discharged during the year for good and sufficient cause, such as drunkenness or bad workmanship, or who leaves the employment of the company without consent of the superintendent in writing, shall be entitled to any share. Discharge because of mere lack of work for him shall not, however, deprive a hand of his dividend.

But the value of all labor contributed to the business for the year shall, for the purposes of a dividend, be treated as so much capital, "which capital, having been returned to the laborer in the form of wages, is still entitled to a share of the profits in just proportion to the amount contributed during the year in which such profits are made." Mr. Batterson then describes his plan for the division of the dividend to labor:

"The true value of all labor contributed as aforesaid shall be determined by the amounts earned, and credited to each workman as wages for labor performed during the year; and the dividend to each will be declared upon the exact amount thus earned and credited to his individual account. For example: Suppose the entire amount of capital employed to be $100,000, and the entire amount paid for labor during the year to be $150,000. Such an amount of capital employed and wages paid ought to insure an output of $400,000 and a net profit of $25,000. Of this amount, one-third, or $8,333.33, would be credited to guarantee account to provide for an assumed loss of about two per cent. on the entire output; the balance would remain for a dividend to capital and labor in proportion to their respective contributions—in this example, two-fifths to capital, $6,666.67, and three-fifths to labor, $10,000, or 6.66 per cent. on each; thus the workman, whose wages for the year amounts to $1,000, would have a dividend of $66.66, and he whose wages amounts to $600 would have $39.96. This dividend to labor would also be materially increased, owing to the fact that all those who take work by contract—superintendents, clerks, apprentices, etc.—do not participate; so that, if each man's labor be treated as so much capital contributed to the business, that capital is not only returned to its owner as wages at the end of each month, but at the end of the year it is again reckoned and rewarded with a high rate of interest."

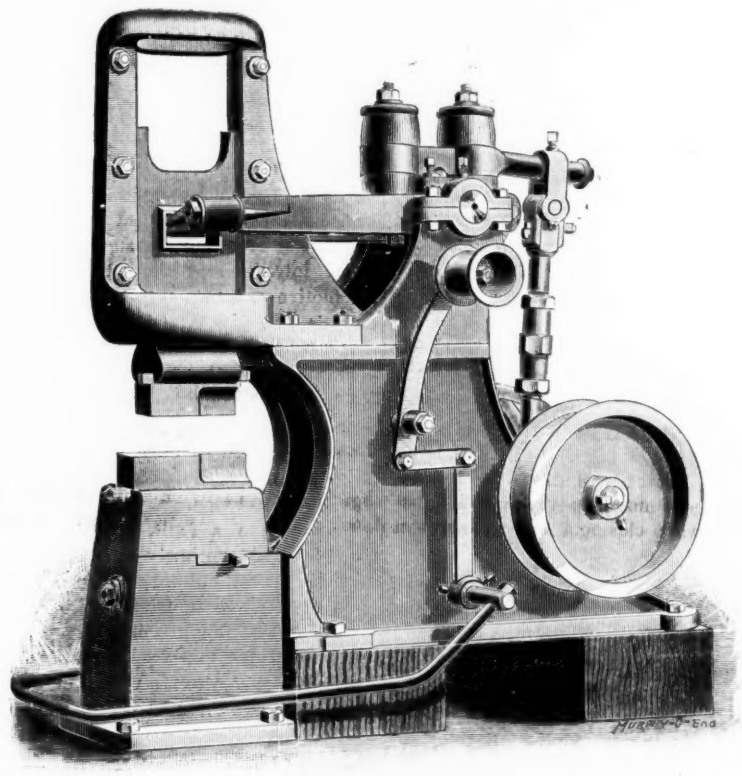
All outstanding accounts and bills receivable at the end of the year shall be treated as good under the guarantee account, and included in the net profits; and if this guarantee fund is not enough to cover the losses, the amount must be made up by the stockholders, while if it is more than sufficient the surplus will belong to the stockholders, who will necessarily have control of the business, for "men employed every day in mechanical labor cannot watch the markets, or possess that aptitude for business management on a large scale which is requisite to success." Finally, work done or money earned by the aid of machinery will be counted to the credit of labor, and will share in the distribution of profits the same as day's work or piece work.

This plan of Mr. Batterson will doubtless seem entirely fair, so far as the workmen are concerned, to those who are accustomed to the management of large enterprises; but the mind of the laborer is likely to find it confusing, and even if it be accepted by those in the employ of the company, they will probably be disappointed when they come to see the balance sheet for the year. Their individual dividend may be less than they expected, for, as Mr. Batterson says, "the profits in one year will be large, in another small, and in another nothing," while, in general, the actual profits of a business of such magnitude are not likely to be so great as those employed in it suppose them to be.

We think the assumption of the *Sun* that workingmen will not be able to comprehend the details of the business connected with this plan is hardly just. Without any occasion for studying such matters in the past it cannot be expected that they will comprehend them so readily, at the start, as business men will. But when they find that they are to share in the profits they will master the principle of distribution without serious delay.

The Beaudry Upright Cushioned Power Hammer.

Since this hammer was first brought out numerous improvements have been made in it, which will readily be seen by reference to the accompanying engraving.



UPRIGHT POWER HAMMER.

As will be seen, the hammer is constructed entirely of iron and steel, with the exception of bronze and anti-friction metal for boxes. The hammer ram is lifted by means of a duplex helve, composed of two arms of tempered steel; the ram is guided in ways or guides, similar to an ordinary drop hammer. The arms which compose the helve are possessed of sufficient elasticity to relieve the machine of strains and jars that would otherwise be destructive. This with the elasticity of the lifting belt and the rubber cushions give a blow substantially like that given by the hand hammer, that is a blow which is elastic instead of crushing. This prevents the jar so destructive to the working parts of hammers where this is not provided against.

The whole machine is simple in construction, and it requires but little practice to acquire proficiency in working. It may be quickly adjusted for special dies; while running at maximum speed the stroke can be instantly varied; when at rest the dies always stand apart, and the opening or distance between them is susceptible of instantaneous change.

Points which the builders of this hammer claim are accuracy, force and elasticity of blow, simplicity of adjustment, great range of work, economy of power and low cost of maintenance.

It is adapted for die work, all kinds of forging in railway and general jobbing shops, and for carriage work, cutlery, spindles, in fact for the widest range of general or special work.

The manufacturers are Beaudry & Cunningham, Boston, Mass.

A curious decision has recently been rendered by the courts of New Jersey, in relation to trade secrets. The complainant asserted that he had discovered valuable secrets in the dressing of leather, and petitioned the court to restrain two men, formerly in his employ, from divulging his secret, which the court did, saying: "A discoverer of a secret process of manufacture, whether patented or not, has property rights therein."

This may be good law, but how will it work in practice? Can these two men, if they enter into the business of dressing leather, be compelled to divulge what they may claim to be their secret of manufacture? Cannot they claim that, while producing identical results, their process is entirely different, and that it would be ruinous to them to divulge it?

It is pleasing to note that several differences between employers and employes have been recently settled by arbitration. These differences will always occur, and this means of settlement ought to prevail to a much greater extent than it does. It is sensible and cheap; although it has, in special instances, been employed for years, it has never received the attention it deserves. Both parties to the controversy appear to forget the existence of such a method, when trouble comes. As an evidence of the attention which arbitration in labor disputes is receiving, and the favor with which it is likely to be received, it may be noted that the Governors of several States have alluded to it in recent messages. Neither party to a labor dispute can hardly ever be characterized as entirely unreasonable. Both simply don't want the other party to have his way, which is rather natural, after all. Often they would not seriously object to a third party having his way.

The *Philadelphia Daily Record*, which pays considerable attention to industrial matters, says: "Machine shop work will be more abundant during the winter than for the past eighteen months, because of expected activity in all industrial channels. Four locomotive works have put on 600 men. Locomotive builders expect orders within thirty days for 100 engines, in lots of from three upward."

The Ronald Fire Engine Works, Brussels, Ont., have started a night school for their apprentices and such of the journeymen as wish to attend. Instruction in mechanical drawing and lectures on steam and the steam-engine are also given. The school is under the management of D. D. Shragg, superintendent of the works. We are indebted to E. L. Cooper for the foregoing particulars.

There has been considerable discussion in England over the question of removing all locomotive crank axles after a certain mileage, which seems to be settling into the opinion that 200,000 miles for iron axles, and 180,000 for steel should be the limit.

An inquirer of the "Questions and Answers" column in the AMERICAN MACHINIST, writes: "Please answer my questions in as simple language as you can." The request is suggestive. The mechanic wants information given to him directly and in plain language.

Foreign exchanges report the invention by Max Muthel, of Germany, of an incandescent lamp for electric lights, which does not require a vacuum in the globe. The manner of making wires is said to entirely overcome the dangers of fusion.

We should be glad to have the address of Theo. D. Morgan, and to know from him whether the device he describes is, or is not, patented.

The use of creosote, liquefied by steam for generating steam, is receiving a good deal of attention in England.

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How Not to Build a Navy.

While the discussion is going on which looks toward giving the United States a navy worthy of such a nation, it is worth while to agree upon two things as things to be avoided in its establishment.

One is to avoid falling into the error of so dividing responsibility between the Government and the shipbuilding and machinery establishments who contract to do its work, that nobody can find out where the blame lies, if the desired ends are not obtained. Let the Government make plain the result it desires to secure, and contractors can then safely be trusted to find ways of accomplishing that result.

Another error to be avoided is, attempting to minutely specify item by item, and detail by detail, in the acts of Congress appropriating money for the creation of a Navy, just how each ship is to be constructed. Let Congress say in general terms how much money it proposes to spend, and how many vessels of such and such classes it proposes to build, then appropriate the money in bulk, and hold the Navy Department strictly to its responsibility for the proper expenditure of funds put in its hands. The following extract from a Washington press dispatch throws a side light upon the latter question:

"One of the leading naval constructors of England, who was in the galleries during the last session, and listened to a debate then pending upon the construction of the Navy, said that it was not to be wondered at that the United States had no Navy, if the plans of the ships had to be determined by a committee of Congress. He said that in the British Commons there were but three or four men who ever ventured to discuss such matters, and they were themselves naval experts."

Making Sketches.

We are always anxious to receive sketches and drawings with letters or articles, no matter whether roughly drawn on a piece of coarse paper, with a rough pencil, or on a sheet of "Whatman's cold pressed," with india ink. The drawings are what we want, no matter how roughly done, provided they tell their story.

At the same time, it stands the man who makes a drawing or sketch to make as well as he can. The drawing sent us is for our benefit; but the excellence of the sketch benefits the maker; and, as the man who can make a sketch is worth more per day than he who cannot do so, it stands to reason that it always pays to make sketches and drawings in the best possible manner.

A Covert Defence of the Prison Convict System.

The report of Isaac V. Baker, superintendent of New York State prisons, shows that official to be apparently very anxious to make out a case in favor of the prison contract system. From such extracts as the following, the casual reader would suppose the State Constitution was seriously at fault in intrusting the selection of the policy to be pursued in the State prisons to the people through the Legislature, instead of to the official placed by them in charge of the convicts:

"There is an apparent exaggeration of the evils of prison competition with free labor. Every man who enters prison and can work in prison was a laborer before he was sent to prison, or he was a drone who lived off other people. If he was the last, he was the consumer of the products of free labor, and paid nothing for what he used. When he supports himself, he relieves free labor of so much tax as he laid upon it. That means relief to free labor. If any convict in prison maintained himself before he went to prison, and is made to do it in prison, he is no more competing with free labor than he was before he got into prison. Shall a man who has assailed society be made the guest of society in prison and a tax upon other men? If every man sent to prison be set at work to pay his way, then the sum of the product of labor in the State is increased, the waste is lessened, and the cost of living in the State is reduced. Free labor gains by the act; it does not lose. Sometimes a special industry may feel the pressure of competing prison industry. But that is something which in a little time finds adjustment, and such friction is removed."

The drift of the above is to make it appear that those who oppose the prison contract system do so because they do not wish the convicts to be employed. Mr. Baker seems to forget that he is addressing the people of the State, and that they have voted to abandon the system he is so anxious to uphold.

The further statement, that the convict "who maintained himself before he went to prison, and is made to do it in prison, is no more competing with free labor than he was before he went to prison," is an insult to the intelligence of every reader who stops to analyze it. Before he went to prison, Mr. Baker's typical convict earned the same wages as other free citizens. Under Mr. Baker's pet system, the power of the State has until recently been invoked to make him a competitor with honest citizens at one-third of their rate of wages.

F. W. Richardson.

We are pained to announce the death of F. W. Richardson, of Troy, N. Y., which occurred at his home on the morning of Jan. 19, after an illness of some weeks. The cause of his death was climatic disease contracted during his travels in the Southern States, and in California. He was but little more than thirty years of age. He had an inherited inclination for mechanics, and learned the trade of machinist while young. He was at one time connected with the lighthouse and fog signal department of the United States Government, with headquarters at Staten Island. Here he was instrumental in introducing several improvements into this department of Government service. For some years past he has been engaged in the machine business at Troy, and has succeeded in extensively introducing balanced slide-valves in locomotive practice, of his own and his father's, George W. Richardson's, designs. Our readers are familiar with recent commendations of these valves at the Master Mechanics' Convention, and by railroad engineers. He had established a prosperous business in this and in other devices of his own invention, and had an extended acquaintance among railroad men.

Generous to a fault, true hearted above suspicion, his untimely death will be sincerely mourned, not only by his relatives, but by a wide circle of friends who recognized his sterling worth and ability.

Cyrus R. Woolson, a well-known resident of Newark, N. J., died of apoplexy in that city, on December 17th last, in his seventieth year. Mr. Woolson was one of four mechanics brought from Lowell, Mass., to Newark, by Seth Boyden, in 1836, to work on the locomotives Essex and Orange, and was one of their first engineers. His life was a busy and successful one, and all spent in mechanical pursuits. He leaves a wife and two children. His large estate will be administered by his son, O. C. Woolson.

Misdirected Energy.

It is astonishing how much of human energy is expended in wrong directions. We do not mean this with reference to honest mistakes; it by no means follows that these are useless. But take the instance of an expert burglar or counterfeiter, sure to die in prison or the poorhouse. He develops talent enough, if his energies had been rightly directed, to have made an honest living and probably a fortune. Aside from noted examples, the amount of misdirected energy in common affairs is enormous. Walking up the hill, and then walking down again is a somewhat common practice with, perhaps, all of us. What is more common than striking two blows where one is sufficient? But probably of all directions the most energy uselessly expended is studying where to begin. Young mechanics, really desirous of studying mechanical matters, frequently waste more energy in trying to determine where they shall start than would be required to master the subject.

In this particular, as we have before this said, the important point is to begin somewhere. It is a difficult matter to tell a young man where to begin to study, but it is astonishing how soon the right direction will be developed if a beginning of almost any kind is only made. There is little or no fear of misdirected energy in making a beginning; where that comes in is in studying where to begin.

Literary Notes.

A Treatise on Belts and Pulleys, by J. Howard Cromwell, Ph. B., contains full explanations of fundamental principles; proper disposition of pulleys; rules, formulas and tables for determining width of leather and vulcanized rubber belts, and belts running over covered pulleys; strength and proportions of pulleys, drums, with the principles of and necessary rules for rope gearing and transmission of power by means of metallic cables.

The tables and formulæ contained in this work will be valuable to the mechanic; a work of this kind should be in the possession of all users of power. The transmission of power, and principles governing it, are well treated in this work.

John Wiley & Sons, publishers, New York.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(46) A. L., Helleforsnas, Sweden, asks: What is the diameter of the cable in use on the Brooklyn Bridge? *A.*—1¼ inch.

(47) S. A. S., Lynn, Mass., asks: 1. How are saw teeth cut? *A.*—They are usually punched. 2. Are circular saws cut the same as common wood saws? *A.*—By some makers, yes. 3. Are the teeth filed after being cut? *A.*—Certainly, before being used; but saw makers do not usually file the saws before putting them on the market. 4. Are there any patents upon machines for cutting saw teeth? *A.*—There may be, but we know of none.

(48) A. B., Halifax, N. S., asks: 1. What is the best substitute for water in a hydraulic press for use in cold weather, where water would be likely to freeze? *A.*—Use alcohol, or oil. Common "black oil" is used by some persons. 2. What is the best form and dimensions of fire-box for burning under a tubular steam boiler spruce wood edging cut 4 ft. long? The boiler is 16′ long, by 4′ 6″ diameter. *A.*—Use ordinary grate bars, but put at least 26″ below the boiler.

(49) F. W., New York, asks: How much coal is equal to a cord of wood? *A.*—Taking into account the different qualities of wood and coal, we may safely call the values two to one, by weight, in favor of coal; or, that one ton of coal is equal to one cord of *hard* and one cord of *soft* wood, burned together. 2. How much coal is there in a car-load? *A.*—It depends upon the size of the car; from two to fifteen tons. 3. How much room will a ton of coal require? *A.*—About one cubic foot for each 50 pounds, or a space 2x4x5 feet per ton.

(50) W. J., Chicago, Ill., writes: I have an engine 8″x12″, running 160 revolutions. The steam pipe is 1⅝″, exhaust pipe 2″. I wish to use the exhaust steam for heating purposes, but must carry it 33 feet to two heaters. I propose to use 2½″ pipe to carry the steam, then branch into heaters with 1¼″ pipe. Will this work well? *A.*—The outlet from cylinder being 2″, we should not make the branches to the heater less than 1⅛″ each, so that the two would at least equal the 2″ outlet from engine. Then it will work all right. We cannot, from data, answer your other question.

(51) C. N. L. asks: 1. How can I tell fire-clay when I see it? *A.*—Put it into the blacksmith's fire. If it cannot be melted by so doing, it may be regarded as fire-clay. 2. How much sand shall I mix with clay when it is to be used around a forge or a cupola? *A.*—No sand is required. 3. Would it pay to build a small cupola, as I am remote from a foundry? *A.*—It might pay as regards the prompt furnishing of required castings, but they would cost more per pound than if melted at a foundry. 4. Would a cupola 18″ inside diameter and 4′ high work with a good, heavy sheet-iron stack? *A.*—It would; but it would probably be necessary to line the lower portion of the stack with fire-clay or brick. 5. What would be the capacity of the above cupola? *A.*—About 500 pounds. You will find full information regarding a small cupola by Robert E. Masters, on page 2 of the AMERICAN MACHINIST, May 16, 1885.

(52) D. D. W., Muskegon, Mich., writes: 1. I have a band-saw pulley 8 ft. in diameter; face 9" wide, 2" thick. The wheel is well turned up, trued and balanced. It is to run 320 revolutions per minute. I have been turning 1¼" square from each outside corner of the wheel face, and shrinking a wrought-iron tire in each space thus turned out. Is the wheel strong enough to safely run at the given speed without the wrought-iron bands? *A.*—If the wheel is made of good material, and well balanced, as is stated, there should be no danger in running the wheel at the given speed. The bursting strain is about 1,800 lbs. per square inch of section of the wheel rim. As the strength of the iron may range anywhere from 10,000 to 20,000 lbs. per square inch, the "factor of safety" is certainly large enough without increasing it by the use of a wrought-iron tire. 2. Can you give me the name of some work relating to the subject? *A.*—See the AMERICAN MACHINIST of Feb. 23 and April 12, 1884.

(53) C. H. B., Pawtucket, R. I., writes: 1. The damper of my chimney is of the full size of the flue, old style, and made of wrought iron. The heat causes the plates to sag so that I cannot keep them in place or check the draft. I propose changing the damper for one of my own construction, consisting of a cast-iron frame and a plate supported by a shaft. I wish to know how much allowance should be made for expansion? *A.*—The frame and plate will both expand equally with the same degree of heat, but the frame being partly exposed to the heat, and partly to a cooler substance, will not get las hot, or exposed quite as much as the damper plate. As the total expansion of cast iron, up to the melting point, is about ⅛ of an inch per foot, the difference in the amount of expansion between plate and frame will not amount to much. We may make the plate ¼" or ⅜" shorter than the length of frame, and the damper will shut close enough for ordinary purposes. The fact that the old damper plates *sag* is strong evidence that the gases escape up the chimney at too high a temperature. This is the source of the damper trouble, caused, perhaps, by poor boiler setting, and should be immediately remedied; this will also probably save many dollars in the cost of coal. 2. Will a cast-iron shaft be better than one of wrought iron? *A.*—No; but it will be less expensive. 3. What should be the thickness of frame and plates; will ⅜" be enough? *A.*—Yes.

(54) Subscriber, South Stillwater, Minn., asks: 1. Should the center of the crank-shaft of a horizontal engine be above or below the center of the cylinder or guides? *A.*—In all cases, the center of crank-shaft should be in line with center of cylinder. 2. How do you find the safe working pressure of a boiler? *A.*—We cannot find the working pressure from the data furnished. 3. What should be the size of a suction pipe for a duplex pump, each plunger being 10" in diameter. We have got a 10" suction pipe, and the pump will not draw until after it is primed. The lift is 15 feet. Is the pipe too large. *A.*—The size of the pipe will make no difference, except as far as exhausting such a large quantity of air may affect its working. Raising water such a distance is sometimes sattended with difficulties when attempted by suction, owing to the difficulty in keeping all parts of the pump air-tight. Perhaps the most practicable method of working a pump in this connection is to water-jacket it by putting it in a tank full of water. By so doing we seal completely all places where air might leak in. Air pumps are frequently made with a water-seal over and around plunger-rods or valve-stems.

(55) F. B., Philadelphia, Pa., writes: We have a pair of compound Herreschoff engines; high-pressure cylinder, 8"x14", low-pressure. 14"x14'. With 100 lbs. steam pressure, cutting-off at ¼, ½ and ¾ stroke, 200 revolutions, what should be the power developed? *A.*—No approximation to the probable power of engines could be given without knowing numerous details of construction of which we are ignorant. In some experiments made with the steam yacht Leila, by the Bureau of Steam Engineering, Navy Department, the indicated horse-power, cutting off at about one-third stroke, in each cylinder was 99.9. In this case, the high-pressure cylinder was 9" diameter, the low pressure 16", and the stroke of pistons 18". The steam pressure was 104½ lbs. The revolutions per minute were 192. These were, presumably, the same kind of engines you refer to. This may be of some assistance to you in forming an opinion, but in compound engines small differences in detail may make important differences in power developed, as well as in economy, and builders invariably work up from experimental research. We have no doubt that if you write the builders they will be glad to give you the results of their experiments. These you can compare with your calculations to your advantage. 2. The screw is four feet diameter, and eight feet pitch. What should be the speed of boat? *A.*—Of conrse you understand that if there were no slip to the screw the boat would move ahead eight feet at each revolution of the wheel. In the experiments previously referred to, the wheel was eight feet pitch, and the slip was from 19½ to 25 per cent. Deducting the slip from the speed without slip will give you actual speed. 3. What power should the wheel absorb? *A.*—In the experiments named the net horse-power applied to the crank-pin (at 99.9 indicated horse-power), was 90.7, and the per cent. of this power expended in ovarcoming the resistance of the water to the surface of the screw blades was 11+; the per cent. expended in slip of the screw 18.5+.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Power measured.–F. Van Winkle, 22 Cortlandt, N. Y.

T. M. Parker, Steel Stamps, Stencils, Hartford, Ct.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 48 Beekman st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

Tack, Wire and Shoe Nail Machinery. Wm. A. Sweetser, Brockton, Mass.

Steel Shank, Wire Nail, Shoe Nail and Tack Machinery. Keith & Trufant, Campello, Mass.

Tack and Wire Nail Machinery, made by the Willets Mfg. Co., Providence, R. I.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

Patent Attorney and Expert. Machine designs and details. Wm. H. Weightman, 82 Astor House, NY

Foot-power Machinery, for workshop use, sent on trial if desired. W. F. & Jno. Barnes, Rockford, Ill.

Lyman's Gear Chart. How to Lay Out Gear Teeth. Price, 50c. E. Lyman, C. E., New Haven, Conn.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John st., N. Y.

Six-spindle Gang Boring Machines, manufactured by Williams, White & Co., Moline, Ill.

Improved Labor-saving Upright Drills, 20-in. to 36-in., inclusive. Currier & Snyder, Worcester, Mass.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham st., N. Y.

E. Merritt & Co., Brockton, Mass., established 1859, only manufacturers of a complete line of Tack and Nail Machinery. Send for circulars.

Files recut without drawing temper, about one-half usual prices; samples recut free; prices on application. The Acme Co., Collinsville, Conn.

Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See Jan. 2, p. 13. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

"Complete Practical Machinist," $2.50; "Mechanical Drawing Self-taught," $4. Books for workmen. Joshua Rose, Box 3306, New York City.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

For Sale—One 50 H. P. and one 200 H. P. Corliss engine, built by Geo. H. Corliss; also one 30 H. P., Erie City Iron Works portable engine and boiler, nearly new, used but a few months. Henry I. Snell, 135 North Third street, Philadelphia, Pa.

The Chandler Water Motor.—Five years' successful trial has proved the Chandler Motor to be the most reliable and economical motor made. Built in six sizes, from ⅛ to 12 horse-power. Efficiency, safety and economy combined. Send for illustrated catalogue and price-list. Factory and warerooms, 132 Oliver street, Boston, Mass.

"Locomotive Engine Running and Management." By Angus Sinclair. Gives full directions about handling and repairing locomotives; instructs how to design valve gear and set valves; Westinghouse air-brake explained by aid of engravings. Price, $2. For sale by "National Car Builder," 187 Dearborn st., Chicago, Ill.

Every young man who aspires to be either a mechanic, merchant, or manufacturer, owes it to himself that he become thoroughly familiar with the writings of Chordal. John Wiley & Sons, 15 Astor Place, N. Y., have issued a new and enlarged 12 mo. edition of "Extracts from Chordal's Letters." Handsomely bound in cloth, with over 50 illustrations. Price, $2. Discount of 25 per cent. on orders for five or more copies.

MANUFACTURES

S. H. Fox, Dunhamville, N. Y., intends to build a glass factory at that place.

A large shoe factory is to be erected at Sharon, Pa., by A. J. Manley, of that place.

Weekly payments are to be adopted at the Mason Machine Works, Taunton, Mass.

A new barrel factory, by Darwin, Rich & Stone, will be built at Oswego, N. Y.

About 15,000 tons of shipping are now on the stocks or in prospect at the shipyards of Maine.

The two blocks of mill property lately destroyed by fire at Kensington, Philadelphia, Pa., are to be immediately rebuilt.

The Beebe & Holbrook Paper Co., Holyoke, Mass., has bought the Connecticut River Pulp Mill at that place. They will erect new buildings and make extensive alterations during the coming season.

F. VanWinkle, 22 Cortlandt street, New York, has added the rearrangement of defective and unsatisfactory steam-heating apparatus to his general business of steam-engine examination and adjustment and measuring power with power-meter.

The paper mill at Council Bluffs, Iowa, formerly run by Reckless & Kennedy, but which has been idle for a year or more, has been purchased by H. Coker, who will make necessary repairs and start up as soon as possible.—*Paper World.*

Thomas Burke, 124th street and East River, New York, informs us that he is doing a fair business with his grate bar for boilers. He has just put in two for Hornthall, Whitehead, Weisman & Co., corner of Broadway and Bond sts., New York.

Forbes & Curtis, of Bridgeport, Conn., manufacturers of the Forbes patent die stock, pipe cutting threading machines, etc., have just finished what they believe to be the largest die stock ever turned out. It was to cut and thread 8" pipe. One man could operate it. The stock was shipped to Russia.

The Straight Line Engine Co., Syracuse, N. Y., write us that their business for 1885 has been fully double that for 1884. The number of engines sold has been something more than double, but prices have been lower. They are putting their new engine on the market, but not to the exclusion of their older type.

The buildings of the Noble Manufacturing Co., of Elmira, N. Y., have been leased by C. E. Jennings & Co., who will soon begin the manufacture of bits, augers, drawing-knives, ship tools and other specialties on a large scale. It is understood that the company have purchased the Noble patents on these tools, which are believed to be valuable.

The Albany & Rensselaer Iron Company, reorganized with a capital of $2,500,000 as the Troy Steel and Iron Company, is running all departments full, except steel. This department will start in about March 1, the works employing altogether 400 to 500 men. They are building a new blast furnace on Breaker Island, below Troy, N. Y.

The new factory of the Crane Bros. Mfg. Co., Chicago, will be ready for occupation in about two weeks. It is to be used exclusively for elevator building, and will be fitted with new machinery and employ about 200 men. The old machine shop is to be divided up and used for the manufacture of wrought-iron goods.—*Southern Manufacturer and Builder.*

Thos. Kane & Co. (manufacturers of steam yachts, boilers and engines), Racine, Wis., write us: "You struck us in a vital spot in your editorial on steam yachts in your issue of January 23. We send you our new steam-yacht catalogue by this mail, by which you can see we are about in the line spoken of." The catalogue describes a line of yachts using water-gas as fuel.

A site 66x150 feet in area has been purchased on Clinton street, Chicago, Ill., between Van Buren and Harrison, by H. H. Scoville, upon which the erection of a factory to cover the entire space is to be begun at once. This factory is to be equipped for the manufacture of stone, mining and hoisting machinery. It is intended to have the factory in running order by May 1.—*Industrial World.*

E. A. Hall, Hyde Park, Mass., is to begin at once the erection of a shoddy mill to give work to forty hands. White Brothers, Winchendon, Mass., have purchased the cotton and woolen mill in that town, and will refit and operate it. Wm. Appleyard, Sebec, Me., will soon build over, preparatory to putting in new machinery for the manufacture of ladies' dress goods—*Journal of Commerce.*

Van Zile, McCormack & Co., Albany, N. Y., write us: "In your January 23 issue appears a paragraph stating that J. P. Witherow is building shops for the manufacture of the Heine boiler. We would say we have just completed two 75 horse-power boilers of the above type for the Troy Iron and Steel Co., and they are ready for delivery. We tested them with a hydrostatic pressure of 250 pounds, with gratifying results. We are all fitted up for manufacturing the above boiler.

A Wheeling, W. Va., dispatch says: "A committee on machinery from the Wellston Steel Nail Company, recently organized by Ironton nailers, rollers and heaters, arrived in this city to-day and placed a contract for sixty-five machines with Wheeling makers. They will go to Pittsburgh tomorrow, where they will place a contract for engines, rolls, shears, etc. The new mill is to be situated at Wellston, Jackson County, Ohio. The company have a paid-up capital of $150,000.

According to the *Journal of Fabrics*, at the old-established works of the Machinists' Association, founded thirty years ago, several departments are being rushed to an extent unknown for years past. Among the orders in hand is one for throwing machinery for Chas. Horn & Co., New York; another for machinery for Hamil & Booth, and a third from Post, Hengeveld & Co, successors to the Wortendyke Manufacturing Company. It is at this establishment that the celebrated newly-invented cam-movement Kessering loom is made.

Thomas Sampson, late superintendent of the Wanskuk and Steere Worsted Mills, of Providence, R. I., has been appointed general manager of the reorganized Washington Mills Company, at Lawrence, Mass. Geo. Ripley, president of the National Hide and Leather Bank of Boston, will continue to act as treasurer of the company for the present, but otherwise the whole executive management will be in the hands of Mr. Sampson. Of the new capital of $1,000,000, only $500,000 has been paid in, and the balance has not yet been called for. Extensive reorganizations of the plant are to be made, but the present purpose is to manufacture woolen and worsted goods for men's and women's wear, as heretofore.—*Commercial Bulletin.*

The Abilene (Tex.) *Reporter* says there is paying business in that town for a first-class roller mill.

Keith & Trufant (Tack and Wire Nail Machinery), Campello, Mass., write us:

We have done a very good year's work in 1885, but prices have been so low as to make it rather unsatisfactory. We have doubled the size of our shop, and put in some new tools, besides a set of wire nail machinery, and now propose to carry on the wire nail business in connection with our machine work. Taking all things together, the outlook for 1886 is very good indeed.

B. Burbank & Co. (Miners of Fluor Spar), Evansville, Ind., write us:

We have much cause to be thankful, as the demand for "Fluor Spar" has more than exceeded any previous year, notwithstanding the general dullness of the iron business. Iron founders and steel manufacturers are beginning to appreciate its merits, and now acknowledge it to be the best and most effective of any of the fluxes, and new parties are the more disposed to give it a test, as we gnarantee it to work as represented, or ask no pay, if directions are followed.

Belding Brothers & Co. are about to put in $12,000 worth of new machinery at their mills at Rockville, Conn., and Northampton, Mass. At the latter place they are putting up a handsome office building, with fireproof storage room in the basement, a dining-room for the help on the second floor, and manufacturing facilities on the fourth. A Rhode Island manufacturer has been engaged to manage the Washington Mills, Lawrence, Mass., and it is now believed that work will be resumed actively very soon.—*Journal of Fabrics.*

Dwight Slate, Hartford, Conn., writes us: "Business for the year 1885 shows slight improvement over previous year in the demand for my regular line of machine tools. Orders for special machinery have helped out, and shop has been run full time, with three-quarter force. For 1886 I look for moderate trade at close prices. No enlargement of shop or plant was made during past year. Orders on hand for special machinery will give employment to good portion of employes for three or four months to come. Have made some radical changes in my line of drills. Patterns of the old sensitive drill, now termed No. 1, have been altered and improved. An entirely new style, No. 2 sensitive single-spindle drill, and three-spindle sensitive drill, each with new and novel devices that make them desirable tools, have been brought out. Price of labor remains the same. Price of my drills and grinding machines reduced ten to fifteen per cent., subject to change with price of labor and material.

John Foster & Co., Beloit, Wis., who for the last two months have been remodeling and fitting up the buildings recently occupied by the Eclipse Wind Engine Company, started their new works January 1, giving employment to 125 hands on the finest grades of hand and machine-sewed shoes. Wm. D. Hall, one of the members of the firm, is general manager. They have put in a 35 horse-power Atlas engine, and are fully equipped with all the latest machinery for this class of work, having in operation thirty-two of the large Singer sewing machines. Their cutting-room is 30'x70'; stitching-room, 40'x75'; hand-sewed department, 40'x75'; bottoming and finishing room, 40'x150'; stock room for lasts, 25'x40'; storage room for leather, 20'x60'; store room for finished work and office, 30'x70'. All the rooms are well lighted, and are heated on the overhead heating plan. One noticeable feature about this factory is, there are no children employed. Of the 125 adults, forty of them are young women, who have been educated in their respective branches by this company, only one of that number ever having been employed in any other factory.

Wm. Lowe (Bridgeport Boiler Works), Bridgeport, Conn., writes us: Another year of the battle of life has passed, and we find ourselves in good condition for the competition of 1886. We did more and greater variety of work in 1885 than in 1884, but we did not make the profit that was fairly due us in accordance with the state of trade. This was caused by the competition of those who multiply facilities when none are really needed, and then must take orders at very low prices to fill their increased facilities to cover the extra cost of running expenses and interest to make the little profit obtained before such unnecessary increase of facilities. My predictions as to prices for 1885 have been verified in the low prices ruling the past year, and there seems to me to be no prospect of change for the better, as prices the 1st of January are the lowest I ever knew, *pro rata* to cost of stock and labor, in my business life of over 20 years. I am satisfied, by past experience, that there will be no change for the better until the facilities are filled with orders for at least two months ahead. I find that those concerns who make the necessity for taking orders at unremunerative prices are the greatest grumblers against others and the low prices which they do the most to make—the pot calling the kettle black. The past year we made more and larger Lowe boilers than in 1884, nearly all fitted with all improvements; also more of the Lowe feed-water heaters, and sent them over a broader territory. The orders for the improved boiler fronts and improved furnace increased, and we made more marine boilers, principally for the steam oyster-dredging fleet, and did more general work, so that we ran full time with full force, and some of the time with extra hands, and we are still busy, but we cannot say that there is much prospect for more business and better prices this than last year.

Machinists' Supplies and Iron.

NEW YORK, Jan. 21, 1886.

There are no special changes to note in the general supply and manufacturing business. Prospects for future business look favorable, but dealers and manufacturers are conservative.

Iron—The market in American pig has been quiet for the past week. Both dealers and buyers are inclined to wait future developments, but in the meantime prices are firmly adhered to. We quote Standard Lehigh and North River brands at tide-water $18 to $18.50 for No. 1 X Foundry, $17 to $17.50 for No. 2, and $16 to $17 for Grey Forge.

Scotch Pig—The market is easier; prices are not quotably lower, but the market is in the buyer's favor. We quote Coltness, $19.50 to $20; Glengarnock, $18.50 to $19, to arrive; Gartsherrie, $19 to $19.50; Summerlee, $19 to $19.50; Eglinton, $17.50 to $18; Langloan, $19.50, and Dalmellington, $18.25.

Lead—Transactions in lead are very few. Holders ask 4.55c., but buyers are not inclined to offer more than 4½c.

Copper—The demand for ingot is light. Lake is offered in small lots at 11.45c.

Tin—There is a little firmer feeling in the market, owing to slight advances in London. Jobbing lots of banca have sold at 21½c.; Straits and Malacca, 20.75c.

Spelter—Easier; refined, 5¾c. to 6c.

Antimony—Hallett's, 8¼c.; Cookson's, 9½c.

✻WANTED✻

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Traveler wants engagement to make occasional trips to push sale of special tools, mfr's. supplies, etc. Traveler, care AM. MACHINIST.

Wanted—Situation by machinist of much experience (several years as foreman); would take work by contract. Address L. W., AM. MACHINIST.

Late chief engineer of large refinery is open for engagement Feb. 1, in any mechanical position. Address "New York," AM. MACHINIST.

Wanted—Position in machine-tool establishment; experienced in designing and in the management of men. X. Y. AM. MACHINIST.

A thorough and practical mechanic, of 20 years' experience, desires a situation as foreman or superintendent of a machine shop. Address, Box 60, Gloucester City, N. J.

Wanted—Situation as foundry foreman; large experience in machinery and steam work, management of men, and mixing of metals; good references. Address Moulder, 424 12th st., Chicago, Ill.

Engineer competent to take charge of engine in large manufacturing establishment near N. Y.; must be good machinist and have first-class references. Address S. P. L., AM. MACHINIST.

Situation by a first-class pattern-maker and draftsman; qualified for a position needing the above separately or together; highest references. Address Box 15, AM. MACHINIST.

Wanted—Draftsman experienced in printing machinery. Address, stating age, extent and character of experience, education and expectations as to emolument, "Sebastian," AM. MACHINIST.

Wanted—A young man as draftsman; one who would be willing to make himself useful as pattern-maker or machinist, should occasion require. Address C. A. Lieb, 27 Vandewater st., N. Y. City.

Wanted—By mechanic, position where ability is appreciated; can make patterns, do machine work, draft, and design; would be a valuable man in the production of new machines. Address A. M. D., AM. MACHINIST.

Position Wanted—An A1 mechanical draftsman, in N. Y. City or vicinity, whom I have had in my employ for seven years; will gladly give him high testimonials. "Well-known Engineer," AM. MACHINIST.

Wanted—Situation as supt. of machine works; thoroughly acquainted with the designing and construction of steam-engines (stationary and marine), machinists' and boiler-makers' tools, mining, rolling mill and furnace work and pumping engines; thirty years' experience; references given. Address, N., AM. MACHINIST.

Wanted—A foreman boiler-maker; the successful applicant must understand his business, be a man of push and energy, a good manager of his men, and present references of his character and ability; the position is a permanent one, with a large concern, 12 hours from New York City; a foreman used to fire-box and stationary work preferred. Address "Eclipse," AM. MACHINIST.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

The Cyclone Steam Flue Cleaner has no equal. Crescent Mfg. Co., Cleveland, Ohio.

Light mach'y of all kinds built at short notice. Penington & Mills, 8 Dey st., Jersey City Heights, N. J.

Special mchs. for any kind of mfg. designed to order. Also plain and autom'c eng's. Send for circular and refs. Weston & Smith, Syracuse, N. Y.

Wanted—To exchange, a 6" "shaper" for a small "bolt-cutter." Address, for particulars, Lewis Blount, Durham, N. C.

To make room for larger tool, will sell cheap, for cash, a planer 42"x42"x12', in good order. Address P. O. Box 2085, Bridgeport, Conn.

C. F. Langston & Co., 222 N. 5th st., Phila., can-makers' tools, presses, dies and special machinery built, rotary cutters made and ground.

For Sale—Sole right of patented wrought-iron warehouse truck. Address Robert Kent, 49 Jay st., Brooklyn, N. Y.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Gear Cutter—For sale, cheap, by Fitchburg Machine Works, manufacturers of machinists' tools, Fitchburg, Mass., one second-hand 36" (Putnam) gear cutter, in good condition.

Engine and Boiler—30 horse-power Buckeye engine; 42"x12' tubular boiler; all pipes and fixtures, including injector, heater and smoke-stack; the whole in good condition; in use about three years; to be replaced by larger engine, etc., of same make; can be seen in operation until Feb. 1. Address Geo. A. Barnard, 70 Astor House, New York.

H.W. JOHNS' ASBESTOS

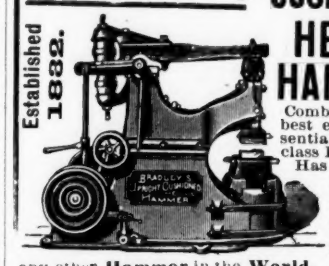
Roofing, Building Felt, Steam Packings, Boiler Coverings, Fire Proof Paints, Cements, Etc.

Samples and Descriptive Price Lists Free.

H. W. JOHNS M'F'G CO., 87 MAIDEN LANE, N. Y.

175 Randolph St., Chicago; 170 N. 4th St., Philadelphia.

BRADLEY'S UPRIGHT CUSHIONED HELVE HAMMER



Combines all the best elements essential in a first-class Hammer. Has more good points, does more and better work and costs less for repairs than any other **Hammer** in the **World.**

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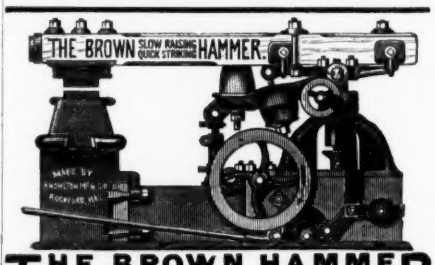

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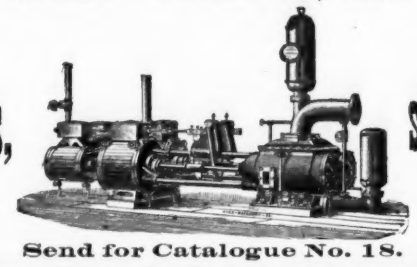

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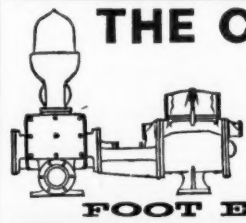

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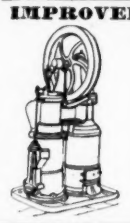

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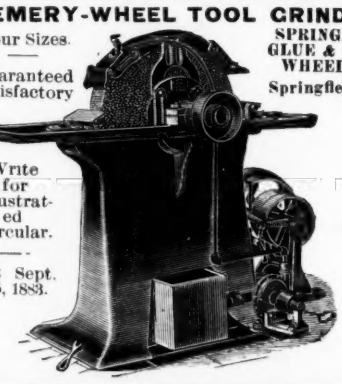

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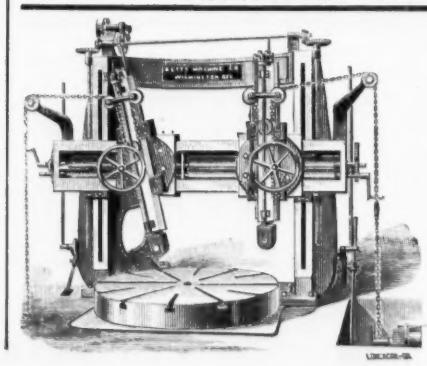

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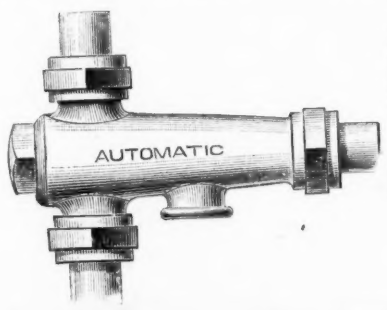

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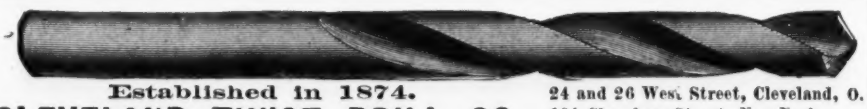

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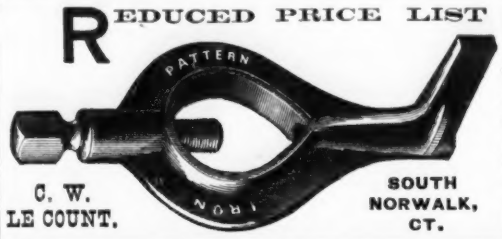

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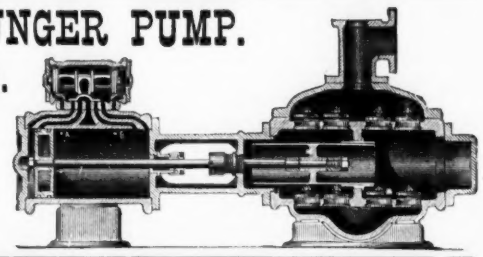

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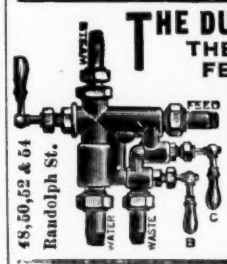

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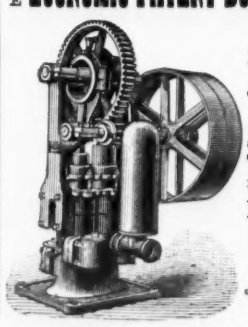

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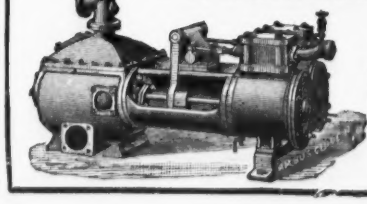

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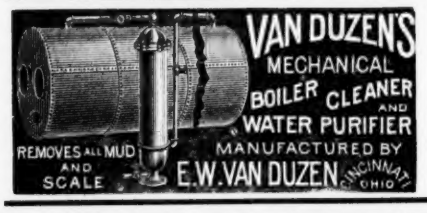

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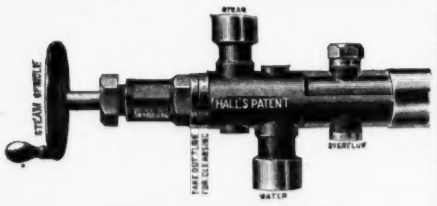

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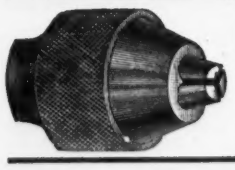

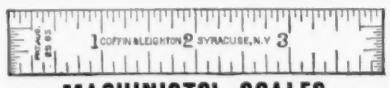

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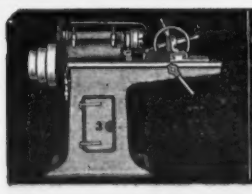

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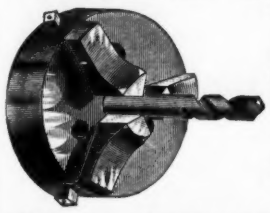

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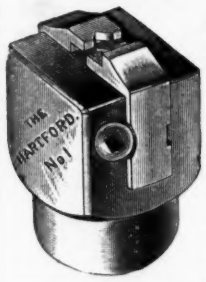

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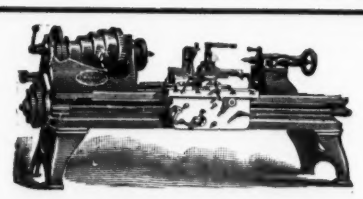

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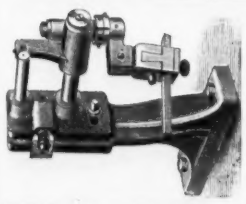

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Below we publish, under this heading, references to a small portion of the practical articles that have been specially prepared for the AMERICAN MACHINIST, and have appeared in our columns during the last few months. No other mechanical journal in this country has or ever has had such a collection of practical articles, by writers of well known ability, as are presented in these columns week by week. Every issue gives information that is taken up and applied in the shops and factories in various parts of the country. Copies containing these articles can be readily obtained by ordering of any newsdealer, or by writing to this office, at 5 cents per copy.

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How to Originate a Scale of Equal Parts. Sept. 6, 1884.

Wm. H. Harrison.
The Development of the Connecting Rod. Sept. 5, 1885.
Balancing Revolving Bodies. March 21, 1885.

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Oiling Locomotive Valve Motion. May 23, June 27, 1885.

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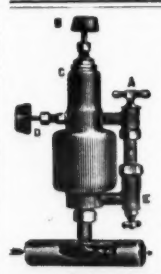

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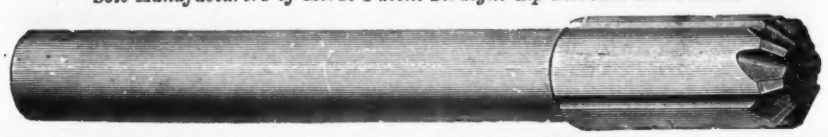

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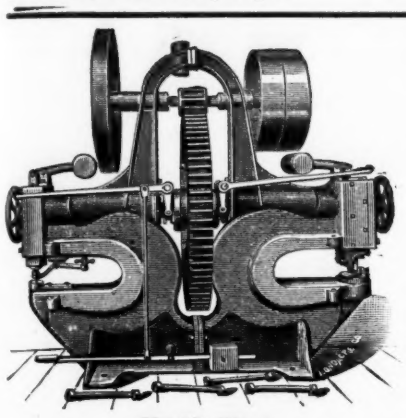

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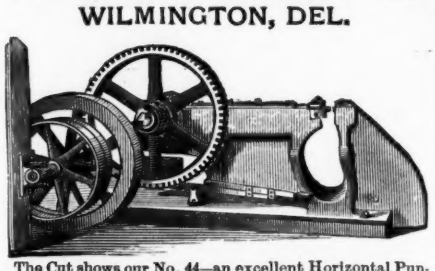

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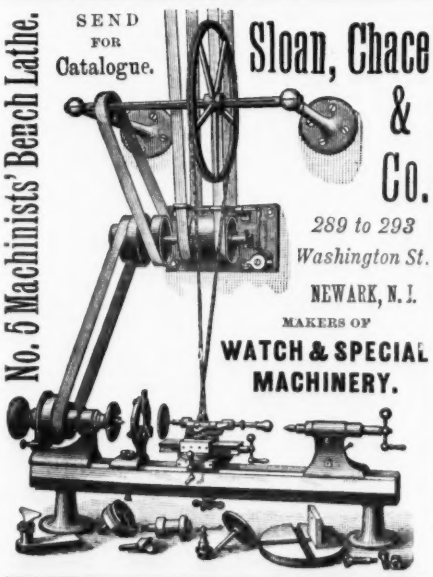

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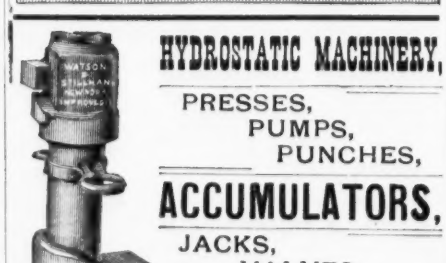

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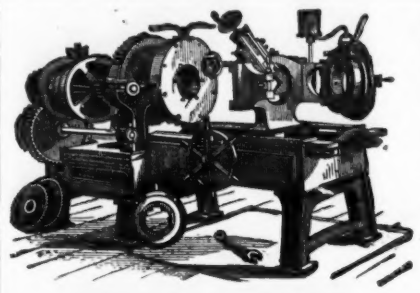

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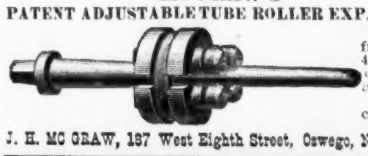

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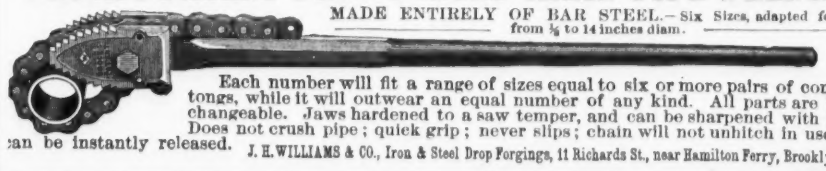

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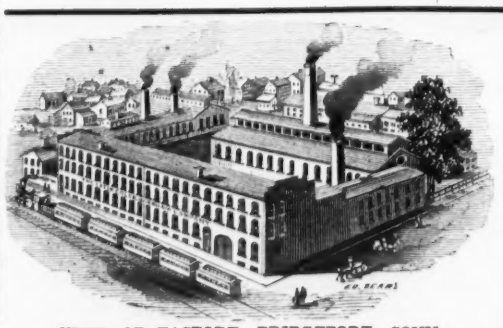

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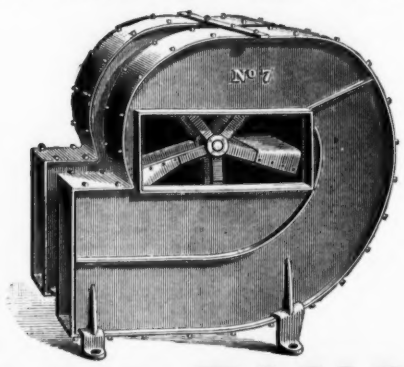

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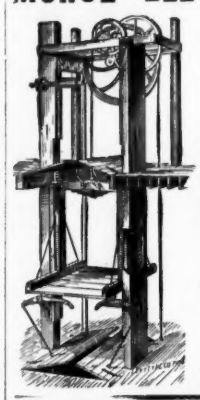

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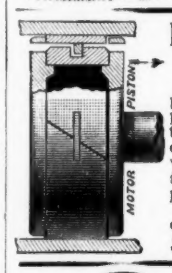

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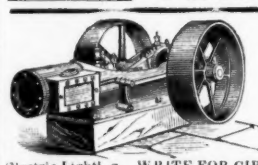

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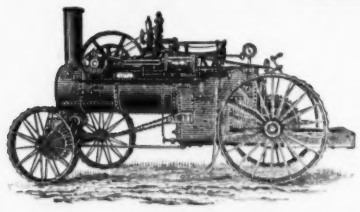

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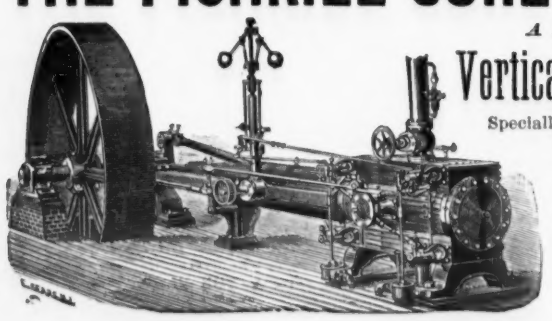

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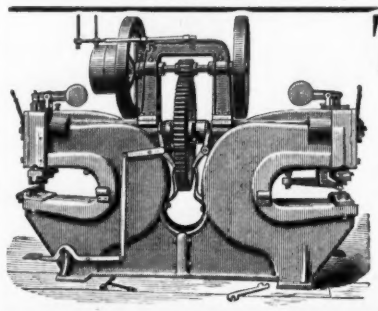

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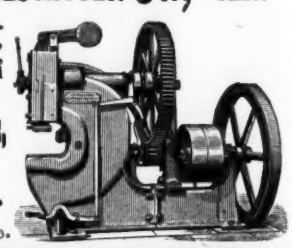

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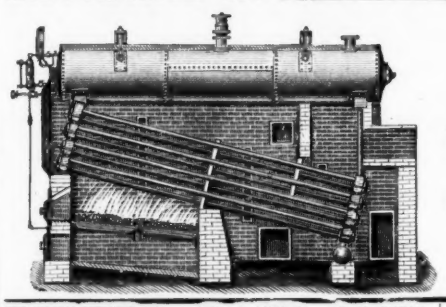

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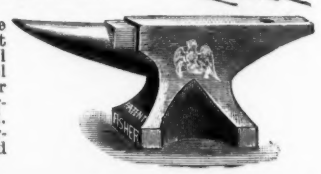

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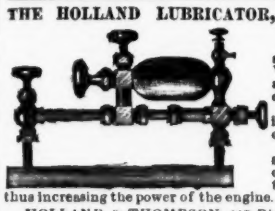

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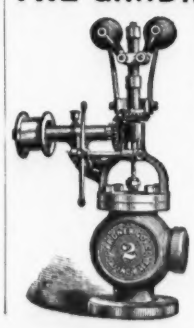

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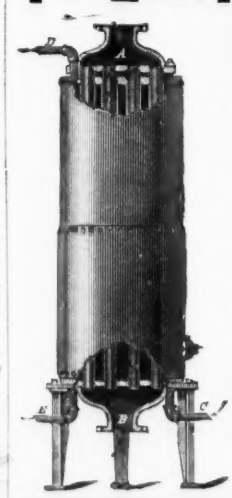

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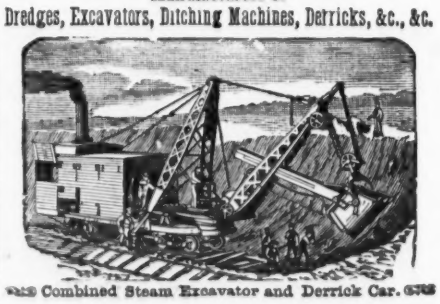

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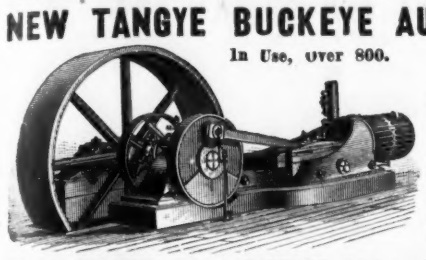

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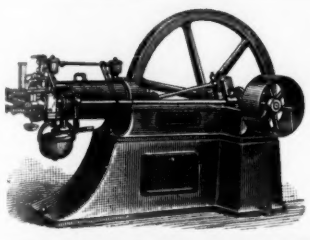

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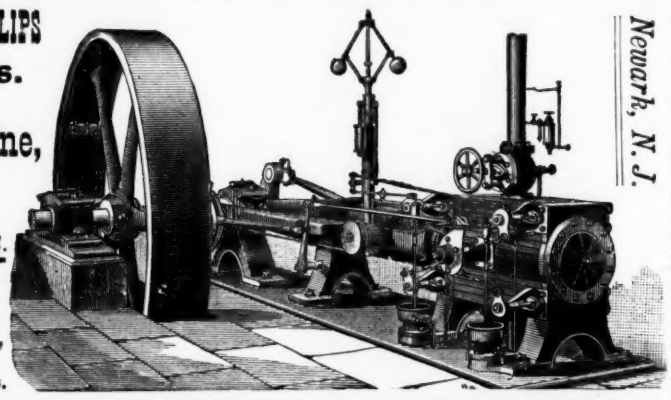

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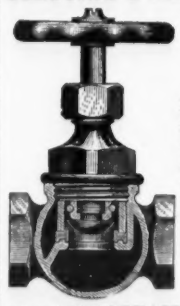

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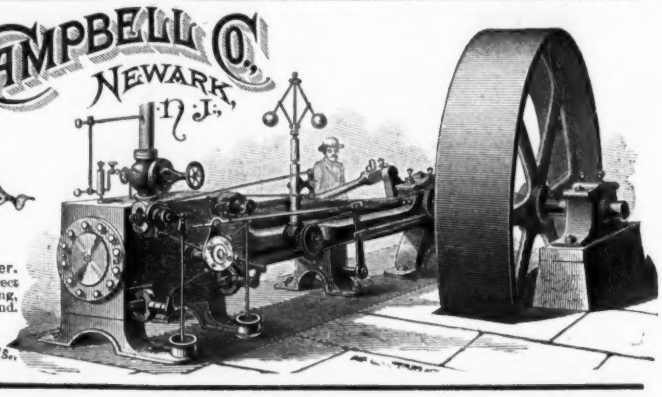

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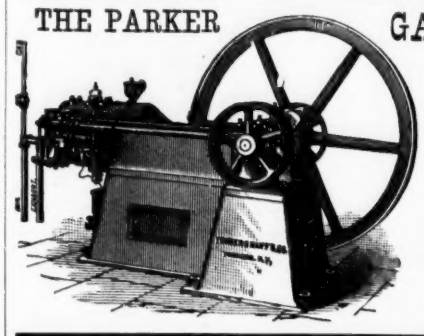

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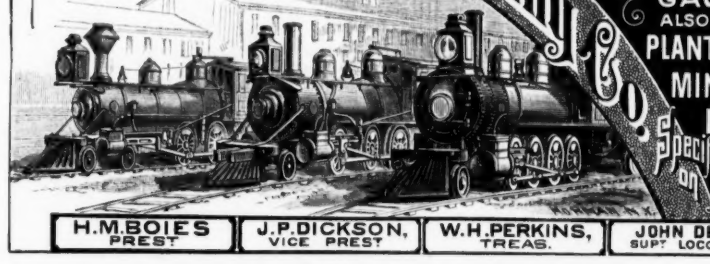

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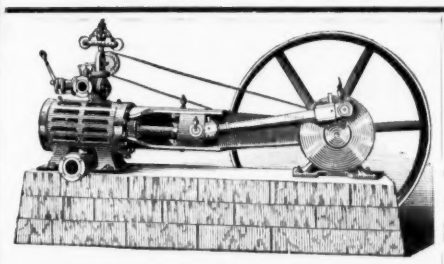

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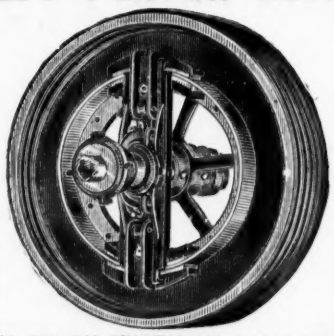

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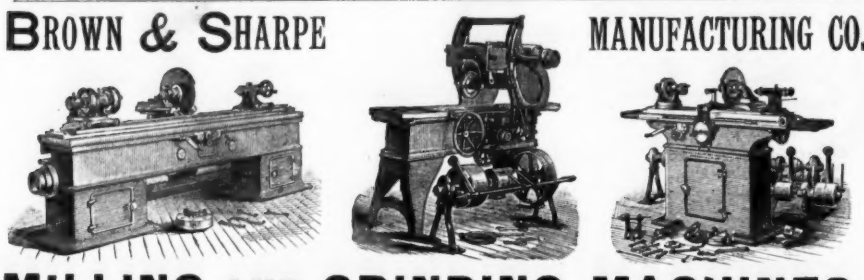

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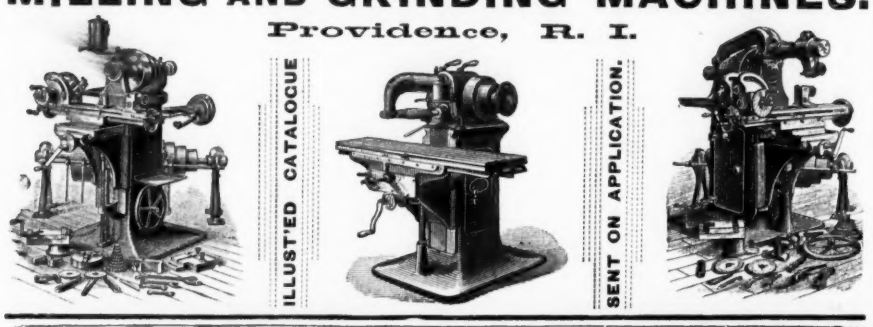

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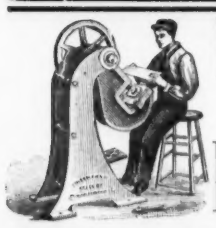

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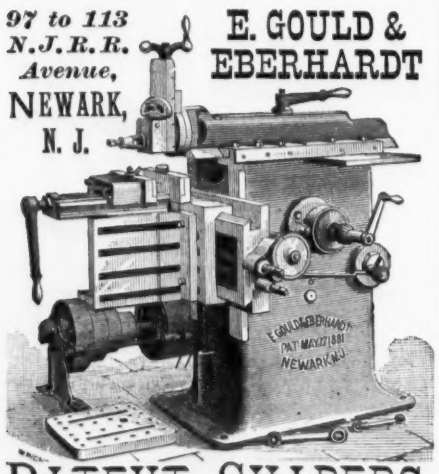

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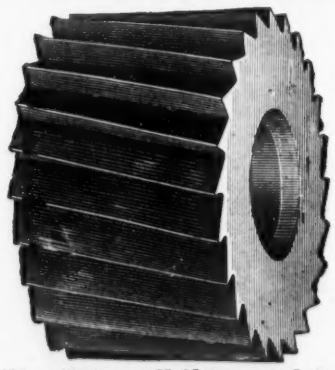

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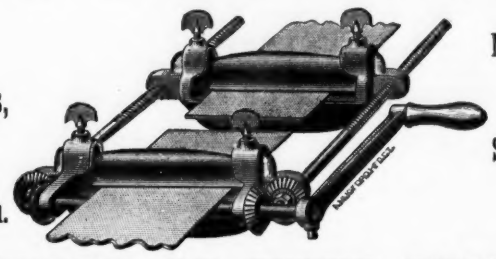

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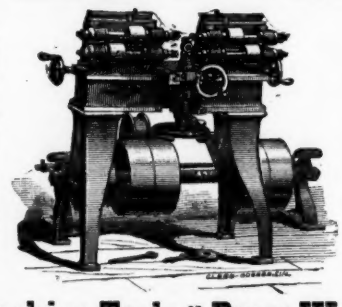

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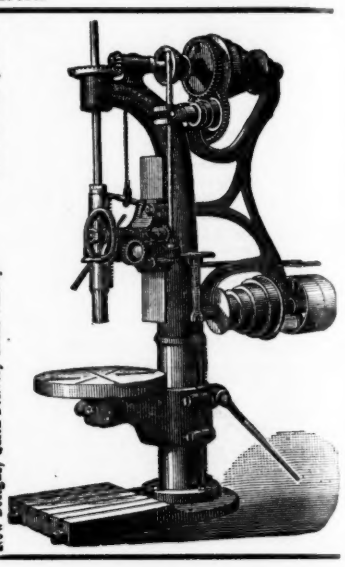

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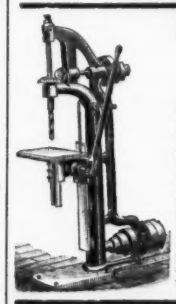

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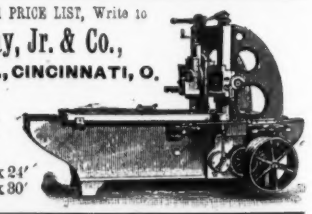

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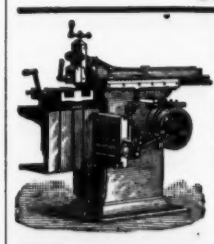

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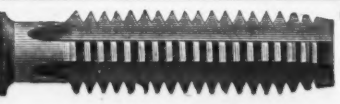

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